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THE ULSTER MEDICAL JOURNAL

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The Ulster Medical Journal

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THE ULSTER MEDICAL SOCIETY

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This covers one volume (two numbers) of the Journal.

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THE
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VOLUME 51 1982 No. 2

THE DEVELOPMENT OF IDEAS CONCERNING THE CONDUCTION SYSTEM OF THE HEART

by

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IN a profession as rich in proud tradition as medicine is, it is not only an honour but a special privilege to participate in any commemoration of our heroes. Robert Campbell was clearly one of these, a man who combined in an exemplary way the skill and compassion of his professional work with an abiding love of scholarship and culture. In his own Campbell Oration just over 20 years ago, Dixon Boyd recalled him thus " . . . . a successful and busy surgeon who read Shakespeare in a tram-car, and read him with critical and sensitive attention".[1]

Unsurprisingly, Robert Campbell is remembered especially as a teacher of surpassing talent, including some time spent as a demonstrator of anatomy. In teaching the medical students here in Belfast he listed as his first principle: "The basis of clinical work should rest on a sound knowledge of anatomy and physiology".[2] It is a principle to which I wholeheartedly subscribe, but I fear that one part of it has become an unwanted stepchild in many medical schools.

This work was supported by the National Heart, Lung and Blood Institute (Program Project Grant HL 11,310 and SCOR on Ischemic Heart Disease HL 17,667) and by the Underwood Bequest for Research in Heart Disease.

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For reasons that are not particularly clear to me, most medical students and many physicians have lost interest in anatomy. During the period of special turmoil among students the world over in the 1960's, there was serious talk of dropping anatomy from the medical curriculum, said to be a subject of dubious "relevance", a magic word of the time. Perhaps naively, I breathe a sigh of relief that this sort of frenzied insanity seems to have waned.

Critics of anatomy in the curriculum remind me of the exchange between Robert Hutchins of the University of Chicago and a reporter who asked "Do you still teach communism at the University?", to which he replied "Yes, and cancer at the medical school".

To be sure, some of the criticism of anatomy is warranted, for the work of some anatomists has not kept about it that air of freshness which is just essential for effective teaching. It is so unnecessary for such teaching to be stale. When asked "The structure of the body hasn't changed much since Vesalius, has it?", Lactantius is said to have replied "No. Neither has the atomic nucleus".[3]

In his presidential address before the American Association of Anatomists Don Fawcett[4] remarked "It is debatable whether the greenish hue of our image is the fine natural patina that comes with age and exposure or whether it is an incipient gangrene". Fawcett then particularly deplored the lack of precision today in photomicrography, whether of the light microscopic image or that made with electrons, leading to a regrettable and too ready acceptance of pictures out of focus, badly printed, or otherwise poorly presented. It is errant nonsense, he emphasized, to claim that lack of attention to detail is any more tolerable for presenting anatomical data than lack of statistical validity is in physiology or biochemistry. A sloppy photomicrograph is not just an offence to the senses, it betrays sloppy thinking.

Having microscopy as one of my own research interests, I am particularly sensitive to Fawcett's message. In an advertisement commenting upon a course to be offered on photomicrography by the New York Microscopical Society (founded in 1877) jointly with the Royal Microscopical Society (founded in 1839), the Kodak Company explained that whereas microscopy was once considered an academic discipline on its own, today one is expected to learn all about it from the instruction booklet left by a sales representative, as if a microscope were more like an electric toaster than a French horn.

Sir Arthur Keith, of whom I will speak more later, thought that his failure to find an AV (atrioventricular) conduction system in the bird's heart was because of his own faulty microscopic technique, adding that he had always envied masters of such technique almost as much as he envied his friends who could hold free converse in foreign languages.[5]

Of course, defending anatomy in Belfast may be the penultimate form of coals for Newcastle, for your own Thomas Walmsley was not only himself one of the great cardiac anatomists but he taught and inspired a generation of other anatomists who went on to distinguished careers throughout Great Britain, one especially notable one being Dixon Boyd, late of Cambridge. On a more personal note, my own introduction to Belfast was by way of anatomical collaborative studies, first with your Vice Chancellor Peter Froggatt and later and continuing with your State

Pathologist, Professor Thomas K. Marshall. These have been experiences remarkable for me not only because of their intellectual stimulation but no less for the lasting friendships which I have come to cherish.

From my Belfast collaborative studies, as well as related ones before and since, my interest has been inescapably drawn to the historical development of our knowledge concerning the conduction system of the heart. Man has been so fascinated by the heart beat throughout recorded history—witness the ritual excision of human hearts in Aztec sacrifices, a people who incidentally left no written history —that it is difficult to know just where to begin, or whom to accredit. What I shall do with your indulgence is to recite a litany of heroes personally chosen for what their work has meant for me, and take the liberty of interspersing a few of my own observations.

It is no exaggeration to say for electrical activity of the heart, as can be said for all of biology or even all of science, that the growth of our knowledge in the past few decades transcends all prior accumulated information, often by several orders of magnitude. And yet, the very foundation for what we presently know and for what we still seek to know about this subject was carefully and precisely laid in the astonishingly short period between 1893 and 1907. Those who then opened the windows to horizons which are still new were Arthur Keith, Wilhelm His, Jr. and Sunao Tawara. Earlier contributions from Johannes Purkinje were recognized entirely in retrospect and, with no disrespect intended, afford an almost comic relief in the drama of this story.

Before proceeding to some description of these special men's works, every one of which, incidentally, dealt with *histological* anatomy, it may be well briefly to examine the temper of those times. The intellectual psychological ferment of the late nineteenth century indisputably had a powerful influence on what may be seen as a solar flare of science.

For about the second half of the 1800's there was a growing and eventually furious scientific debate between those who had held that the process of cardiac excitation spreading from the atria to the ventricles was by way of nerves and those who said it was muscle. This argument between neurogenic and myogenic theorists neared its peak intensity in 1890. Then as those pioneers to whom I have already referred began to publish their work, a second force came into play, what may be called scientific chauvinism, a trait more powerful and pervasive than most of us would enjoy admitting. Remember that my cast of characters includes a Japanese scientist working in Germany, a multi-national German in Berlin, a modest Englishman working with a medical student neighbour, and a Czechoslovakian physiologist who had dabbled in everything.

There are several reasons why I will begin with Sir Arthur Keith.[6] From all accounts Keith (Figure 1) was a thoroughly likeable, honest and meticulously careful scientist who had that special ability to bring bits and pieces of knowledge together into a wondrous whole. He is also, with young Martin Flack, indisputably the discoverer of the sinus node, where the heart beat normally originates. Finally, of all elements of the system for impulse formation and conduction within the heart, it is the sinus node which I confess has long been the most fascinating to me. I might digress to add that my introduction (by correspondence) to J. Dixon Boyd, one of

Figure 1.
Sir Arthur Keith in 1912 at age 46.

your most illustrious alumni, came because of my defense for Thomas Walmsley's simpler and more accurate term "sinus node" instead of the more cumbersome and anatomically misleading sinoatrial or sinoauricular node. Boyd applauded my decision to buck what was then a trend, and recalled from his own memory how strongly Walmsley, his teacher here in Belfast, had felt about the same matter.

Just after the turn of the century, Keith and his wife were renting a farm house in Kent when he received a letter from Sir James MacKenzie informing him of Tawara's discovery of the AV conducting system. MacKenzie then began sending Keith hearts from cases of cardiac irregularities to see if there was a pathological basis. Even today one is mystified about what it was that MacKenzie suspected, given that electrocardiography was just being born and the sinus node had not even yet been discovered. Undaunted, Keith began to make many histological sections and was soon intrigued by a localized density of richly innervated right atrial tissue at the junction of the sulcus terminalis and superior vena cava. Uncertain of its functional significance and unaware of Tawara's "knoten" at the time, he only made a mental note of this curiosity.

In the long summer vacation of 1906 Keith, having converted the study of his farm house into a histological laboratory, assigned to his medical student neighbour, young Martin Flack, the examination of a variety of mammalian hearts. Returning one hot afternoon from a bicycle ride with his wife, Keith found Flack all excited with what he had found from serial sections of the heart of a mole. Because he remembered seeing a similar structure in the human hearts from MacKenzie, Keith set to work with young Flack to examine the same location in a remarkable array of species. There were fish, amphibia, reptiles, birds, and the following mammals: mole, porpoise, kangaroo, whale, shrew, ram, pig, horse, fetal gibbon and two human embryos. However, it was the memory of what he had seen in MacKenzie's hearts, and subsequently, knowledge of the similarity of this newly found structure to Tawara's knoten which led Keith to postulate (correctly) that the sinus node was the origin of the heart beat.[7]

Although Keith had gone to Leipzig for a few months in 1895, thinking to study with His the elder, who was an outstanding embryologist of the day, he did not stay in Leipzig. Nor is there any record to my knowledge that he ever worked with His the younger or with Tawara, although it seems inconceivable that they did not eventually meet or at least correspond.

Less familiar to most than the 1907 work on the sinus node[7] is another report by Keith and Flack published the previous year.[8] Although the title of the 1906 paper referred to the AV bundle, this remarkably lucid description also dealt with the AV node, the bundle branches and the Purkinje system. It was a complete and enthusiastic confirmation of Tawara's recently published studies,[9] which Keith very obviously admired. It also went a long way toward producing an intelligible synthesis of a concept for a cardiac conduction system, a concept crowned the next year when the actual source of the cardiac impulse was first reported.[7]

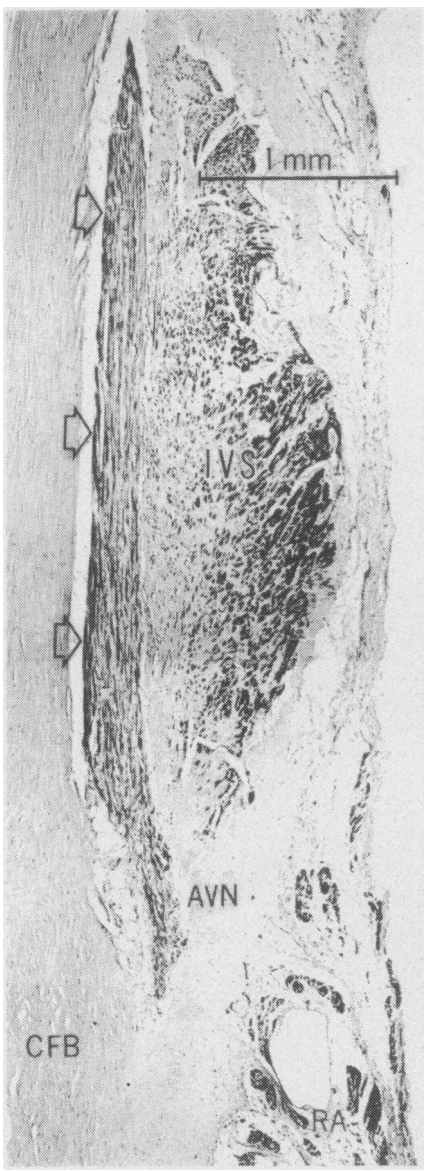
Keith did not stay with the sinus node nor the conduction system, and I am not sure why. He was a man of very broad interests, beginning with three early years in Siam where he studied botanical specimens and anthropology (monkeys), and where he nearly died of falciparum malaria. His life work on human embryology and anatomy produced an admirable book which went through six editions.[10] One vexing experience was his tangential involvement in the controversy about the skull of Piltdown man,[6] an issue in which he was ultimately proved to be correct, but he was too gentle a man to battle with those who were more vocal but wrong. For his exceptionally accurate anatomical discovery of the sinus node and correct appreciation of its significance, for his generous admiration and quick confirmation of the work of Tawara and his early and thorough expostulation of its importance, and for a full life of quiet scholarship, Keith ranks very high in my own pantheon of heroes in medical science.

Sunao Tawara (Figure 2) was born in Oita prefecture in Japan in 1873. After graduating *summa cum laude* from Tokyo University as a doctor of medicine in 1901, he was accepted in Marburg, Germany, in 1903 to study with Ludwig Aschoff. From those three years in Marburg he published in 1906 his monumental work, "Das Reizleitungssystem des Saugetierherzens", with a foreword by Aschoff.[9] As was quickly grasped by Keith and others, including his German mentor (Aschoff), Tawara's book was not only a masterly distillation of his own meticulous work but a brilliant synthesis of existing knowledge about the conduction system into an integrated whole. The only major element missing was the sinus node, and Keith and Flack soon gave us that, in part being guided by knowing about Tawara's "AV knoten".

Figure 2.
Sunao Tawara of Japan.

Tawara knew of the important report by His in 1893, as did Keith and other contemporary students of the subject. But Tawara was the first to describe how the His bundle was expanded at its proximal end to form a meshwork of slender fibres compacted together like a knot or node

(Figures 3 and 4). In addition to his generally recognized priority for discovery of the AV node, he probably also deserves credit for first recognizing that the His bundle divided into consistent right and left branches comprised of fibres such as those originally described by Purkinje in 1839[11] and 1845.[12] Tawara correctly interpreted that the AV node, His bundle and its branches together formed a system whereby all electrical impulse propagated from the atria to the ventricles in the mammalian heart, including that of man. Tawara's histological illustrations are still as accurate



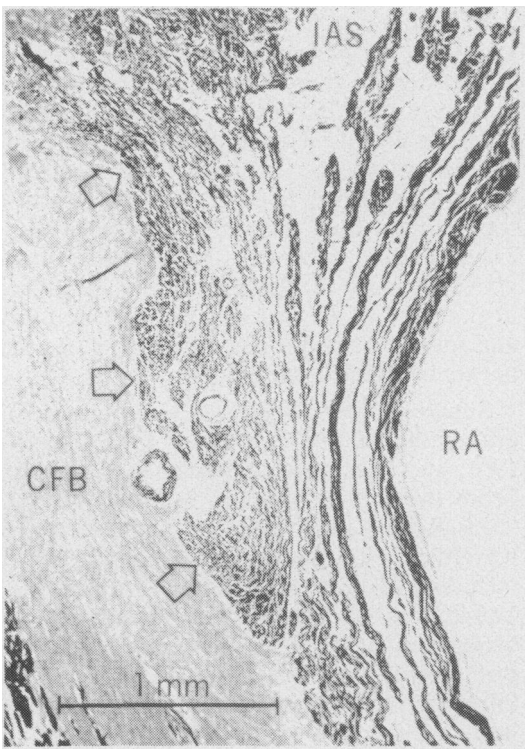


Figure 3 (left).
This horizontal plane section of a human His bundle (three open arrows) shows its proximal expansion into an AV node (AVN). CFB is central fibrous body, RA right atrium and IVS the crest of the interventricular septum. Goldner trichrome stain here and in all other photomicrographs unless otherwise indicated. All magnifications are indicated with reference bars.

Figure 4 (above).
This frontal plane section is made through the AV node (three open arrows) of a normal human heart. RA indicates the chamber of the right atrium and IAS is interatrial septum.

as they are beautiful, but it was his original and imaginative description of just how the system was organized and exactly how it worked that is equally beautiful.

When Tawara returned to Japan in 1906, he served as associate professor of pathology first at Kyoto and then Fukuoka medical schools. In 1908 his alma mater in Tokyo awarded him a special degree in recognition of his research, and in 1910 he became professor of pathology at Kyushu University, where he remained until his retirement in 1930. In 1914 he received the Japan Academy prize for his work on the cardiac conduction system, but until his death in 1952 he—like Keith before him—did not pursue other aspects of his great original contribution.

Wilhelm His, Jr. (Figure 5) was the worthy son of a famous anatomist. Even in those days, academicians were a peripatetic lot and the young His attended the universities of Leipzig, Strasbourg, Bern and Geneva. He was not only a capable clinician but also a talented violinist and painter. Although he studied gout and certain types of fever, his most lasting contribution was the correct description of the AV bundle which now bears his name.[13] However, while the description by Wilhelm His is almost certainly the first that can be judged to be anatomically and physiologically correct, there was for some time considerable dispute in priority, in part because scientific chauvinism reared its ugly head. There was also fierce and derogatory criticism from proponents of the neurogenic theory of conduction who properly surmised that His's discovery could destroy their raison d'etre.

An early challenge to His's priority came from A. F. Stanley Kent, accompanied by those who wanted to champion British priority for the discovery. It is true that in the same year as His (1893), Kent independently described findings supported myogenic rather than neurogenic conduction.[14] There seems little doubt that Kent did not know of His's work, nor His of Kent's. But there the similarities end. What Stanley Kent actually said[14] was that there were normally multiple AV connections in the mammalian heart, most of which were over the lateral aspects of the AV valve rings, thus claiming to confirm what Gaskell[15] and others had found in the tortoise. Although Kent did mention the septal AV connections in his 1893 paper, he attached no particular significance to them and in later works[16, 17] conspicuously ignored what is today known as the His bundle. In essence, Kent repeated the equally vague and much earlier descriptions of Paladino,[18] an Italian scientist who at a later time[19] also challenged His's priority.

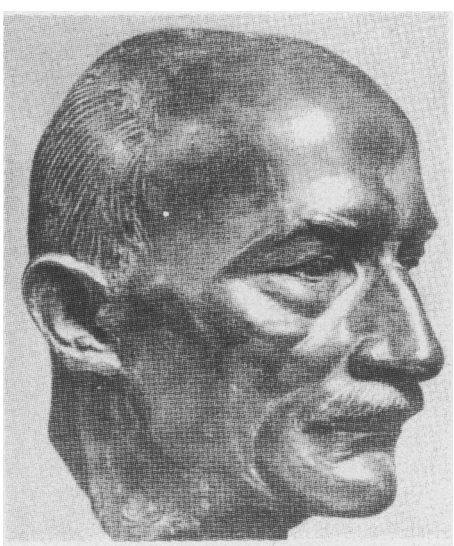


Figure 5.
Photograph of a sculpture of Wilhelm His, Jr.

Following Stanley Kent's initial reports in 1893 and 1984, he did not publish further on the subject for 20 years, a

period during which the work of His was being widely accepted both clinically and experimentally. Finally, in 1913 and 1914 Kent[20, 21] presented a series of reports, most of them in the form of brief abstracts, which purported to prove that AV conduction did not utilize the bundle described by His. He even described an experiment in which he claimed to have severed all AV connections except a right lateral AV strip without significantly disturbing the heart beat. In 1953 Frau, Maggi and Agostini repeated that experiment using the same species (rat) and proved that Kent was wrong.[22]

For interpreting Kent's work in context and for understanding his persistence, Öhnell[23] has suggested that anyone historically interested in the matter should carefully examine the statements available in the reports of two British committees specifically charged with evaluating the question of functionally significant AV connections other than the His bundle. Both committees were organized under the auspices of the British Association for Advancement of Science, one in 1894[24] and the other in 1915,[25] thus corresponding to Kent's earliest and latest work. Somewhat surprisingly, Kent was appointed secretary of both committees and must be presumed to have written the reports, hardly an arrangement to inspire confidence in their scientific objectivity. Sherrington was a member both times, chairing the 1915 meeting. As might be expected, both reports fully supported Kent's position, even using first person pronouns.

One must conclude in truth that Kent saw or found little if anything not already described by Paladino and Gaskell, and even by Henle in 1968,[26] and that he not only failed to grasp the special significance of what he saw in the septa but that he misinterpreted his findings. In his own later biographical recollections of the historical events, Wilhelm His[27] comprehensively compares his own observations and interpretations with those of his challengers, having the advantage of over a half century of subsequent perspective. Now approaching (in about another decade) the centennial anniversary of the report by His, we can only conclude that the true priority is no longer in any reasonable dispute and properly belongs to Wilhelm His, Jr.

Johannes Evangelista Purkinje (Figure 6) is quite a different story and offers an interesting lesson in the nebulous origin of eponymous fame. Born in 1787 the son of Bohemian peasants, Purkinje gave early evidence of being a successful striver. He became a linguist not only skilled in Czech, German and Latin, but he could also speak French, English, Russian, Polish, Greek, Italian, Hungarian, Serbian, Lithuanian and Danish. As a multilingual friend of mine once asked, "I wonder what language he dreams in?" Purkinje was additionally a poet, writing odes and

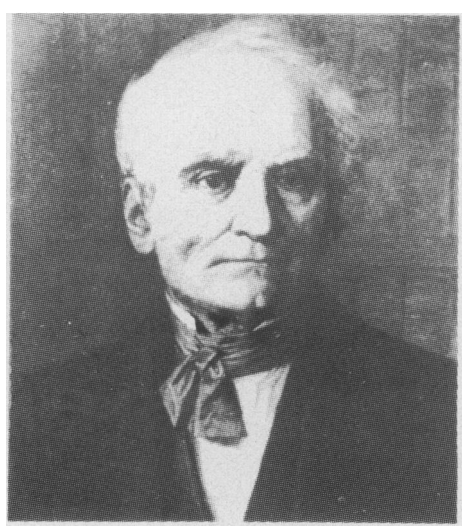


Figure 6.
A portrait of J. E. Purkinje (or Purkynê).

lyrics, but he was a terrible lecturer and hated that form of teaching. Few knew or know just how to spell his patronym, which is found in at least nine different versions in the literature.[28]

There must be very few others in medical history with such a broad range of meaningful scientific interests and contributions. Purkinje not only invented or established the principles for the ophthalmoscope, the spirometer and the hearing aid, but he discovered new aspects of the psychology of dreams, how to do capillary microscopy in vivo, how nerves influence the secretion of gastric acid, and what the germinal vesicle of an egg was. Purkinje was the first systematically to study dermatoglyphics, that arcane science of fingerprints, and he coined the word "protoplasm".

Today his name remains enshrined in anatomy because of Purkinje cells in the cerebellum and Purkinje fibres in the endocardium of the heart. The endocardial fibres were discovered in ungulates, where they are indeed conspicuous structures, but Purkinje was unable to find them in the rabbit, dog or man. He was not even sure what they were, suggesting that they be classified as cartilage. So little was thought of any functional significance for Purkinje fibres that an 1899 biographer[29] does not even mention them among Purkinje's contributions. That may have been a judgement call, but Tawara changed things (and immortalized the Czech physiologist, at least in cardiology) when he chose to discuss Purkinje fibres as the ventricular terminus of specialized conduction tissue in the heart. There has long been and still remains a great deal of confusion and obscurantism about Purkinje fibres. The Czech physiologist (anatomist?) described them as fibres rather than cells. And fibres rather than cells was indeed the prevailing wisdom about the heart until the 1950's and the dawn of electron microscopy. It was only then that the true nature of the intercalated disc as an intercellular junctional membrane became clear,[30] and the myocardium was proven not to be an anatomic syncytium. Paradoxically, very recent studies with freeze-fracture and similar techniques for scanning electron microscopy have re-opened the question, at least to the point of suggesting that the myocardium may function as an excitable syncytium, even if this is not anatomically so.

But there is even greater disagreement as to how to define a cardiac Purkinje cell. Are they present in the human heart (Figure 7), where Purkinje could not find them, or only in ungulates where he did? Are Purkinje cells also present in the atria or only in the bundle branches of the ventricles? Physiologists would have us define them by rapid conduction velocity, reflecting one property with which physiologists are more comfortable, and it is true that conduction is rapid most places where there are Purkinje cells. For example, cells of the Purkinje type are distinctly present in the human atria, particularly in sites of preferential atrial conduction.[31, 32] While these pathways of preferential atrial conduction are not isolated or anatomically shielded as the ventricular bundle branches are, at least in their initial course, regional shielding or non-shielding of a multicellular area is hardly a basis to disqualify any proposed cellular definition of atrial myocytes. Furthermore, arguments as to whether the atrial cells are "specialized" (or not) nearly always take as a necessary definition that specialized means rapid conduction, whereas there are other equally important electrophysiological specializations, as well as anatomical ones.

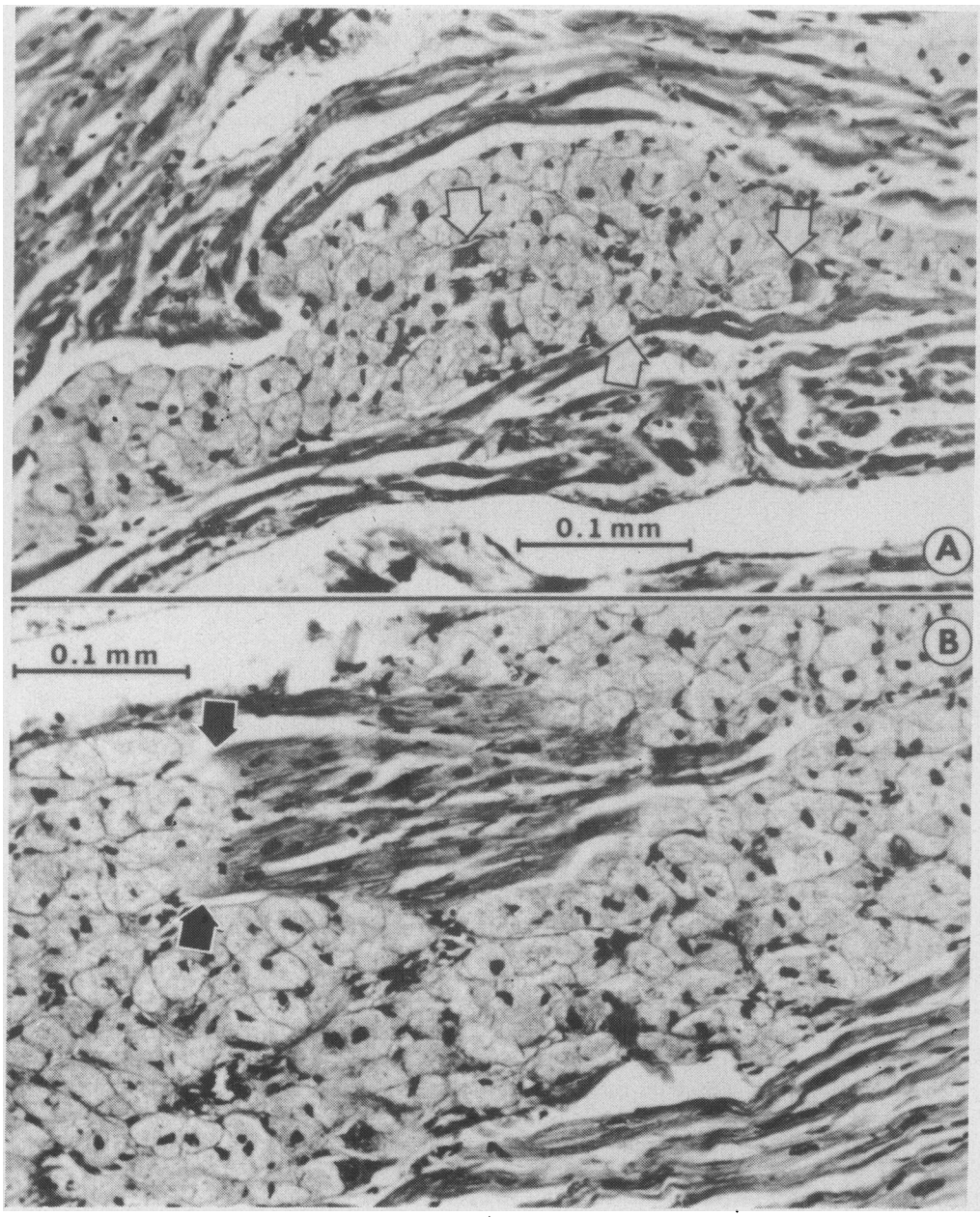


Figure 7.

Human Purkinje cells are clearly visible in these two photomicrographs of a Purkinje cell tumour. The open arrows in A and the black arrows in B mark points of junction with ordinary working myocardial cells.

One electrophysiological specialization in the heart is the property of automaticity, and Purkinje "strands" are a favourite tissue for physiologists to study automaticity. And yet, most such studies ignore three fundamental points. First, Purkinje cells seem specialized for rapid conduction whereas conduction in sites of normal automaticity (such as the sinus node) is always very slow. Second, the only normal automatic centre and primary pacemaker in the heart, the sinus node, does contain specialized cells, but they are not Purkinje cells, differing markedly both by anatomic and physiologic definition. In fact, there are no Purkinje cells in the sinus node. Third, the cells in Purkinje strands, whether studied in vitro[33] or in vivo[34] are not spontaneously automatic under *normal* conditions, and *induced* automaticity differs significantly from that of the sinus node when biochemically defined.[35]

Here we are, nearly a century and a half after Purkinje's discovery, still puzzled about his cells and what they do and exactly where they all are in the heart and how much significance to attach to their species difference. But I believe if Purkinje himself were to judge carefully where he made his major contributions, it would have to be in the science of vision. Even there, however, his irrepressible curiosity ranged widely, and was nearly the cause of his death. Because of visual complaints by his patients (he remained a physician) who had been advised to use digitalis or belladonna, Purkinje undertook experiments upon himself to examine the nature of these puzzling symptoms. Although he subsequently provided vivid descriptions of scintillating scotomata and colour aberrations, as well as nausea and cardiac arrhythmias, after ingesting a huge amount of digitalis,[36] he was lucky to survive. As an interesting recently proposed side light of history, new evidence[37] suggests that some of Vincent van Gogh's most remarkable paintings, including the popular "Starry Night", were but the visual aberrations produced by toxic amounts of digitalis.

Whatever his many scientific contributions may ultimately mean, Purkinje was clearly a master of academic gamesmanship. Both Schiller and Goethe were his literary inspirations, but Goethe's personal influence and recommendation (he was then 74) were additionally instrumental in Purkinje's appointment to the chair in physiology at Breslau at the age of 36. The microscope essential in many of Purkinje's studies was denied him by the university (it cost $50) so he bought one himself. At a time when physiology was being taught by anatomists, Purkinje not only concentrated his efforts (anatomical as well as physiological) in a department of physiology, but he procured separate housing and eventually an institute, a model later to be emulated by many major medical centres in Germany and elsewhere. Some also say that his imagination and creativity declined in inverse proportion to his administrative and bureaucratic triumphs, and if true, it would certainly not be the first or last such lesson from medical history. In his later years he became a fervid Slavic nationalist, eventually dying full of years at the age of 82.

Keith, Tawara, His and Purkinje are names written large in the annals of our knowledge about the conduction system. While Purkinje was the only physiologist of the group, he never studied the function of his fibres, no doubt in part because neither appropriate electrophysiological concepts nor any suitable tools for their study were available in his time. Wilhelm His not only recognized the functional significance of his bundle but correctly anticipated that lesions there could account

for Stokes-Adams attacks, expressing disappointment in his final years that he never had the opportunity to conduct an appropriate clinicopathological correlative study to prove the point, although I am puzzled as to why that should have been. Keith also failed to embark upon physiological studies, perhaps being intimidated by some of the giants already aggressively into the field, but Keith better than most understood the critical intellectual bonds between anatomy and physiology, once emphasizing that William Harvey was fundamentally an anatomist whom the physiologists later stole as their own patron saint. Harvey was of course both an anatomist and a physiologist and undeniably a genius in both fields, as was Purkinje.

Leaving out Purkinje, who was from a different era, why did His, Tawara, and Keith not pursue these logical extensions of their work? Others quickly did. One explanation is surely the invention of Einthoven's electrocardiograph at the start of this century, and the explosive growth of basic and clinical research with it. But many electrocardiographers were eager to seek anatomical correlations, as witness MacKenzie's prescient teasing of Keith's curiosity. Both Keith and Tawara were most comfortable as anatomists and, perhaps due to modesty, did not range far from that field. Wilhelm His may actually have been uncomfortable as an anatomist, living as he did in the shadow of his famous father. But even today there is a perplexing reluctance for most scientists to cross disciplines, a condition which one of my friends aptly describes as "sclerosis of the categories".

If there is a lesson to be learned from this historical view of the work of these four men, it may be that they could have told us more about the conduction system than they did. This is not intended as an irreverent remark but as a tantalizing look at what might have been. Here today and certainly for the future, how can we encourage cross-disciplinary thinking but at the same time escape the spectre of superficiality, thus re-create Renaissance man but not the dilettante?

Is it possible to foster—in today's world of more and more specialization—a greater interest and appreciation of the importance of knowing as much as possible about normal and abnormal structure of the cardiac conduction system, as well as how it works? It would seem to me that one just cannot fully understand how something functions in the absence of knowing just how it is constructed. Many of our worst misconceptions today in both clinical and basic cardiac electrophysiology can be directly traced to the continued prevalence of a shocking ignorance of anatomy.

At the same time I must express grave reservations about the popular approach of team research in science today. Perhaps there is too much to know about some subjects, but it is impossible to know to the fullest *any* subject if only one aspect of it is studied, whether that be its biochemistry, physiology or anatomy. When separate investigators who can hardly understand each other's scientific language, much less the nuances, come to work together, we do not get a hypothetical blending of the best of several worlds. The predictable product is a Tower of babel. Second-hand knowledge, whether gained from books or from a valued colleague, can stimulate, excite and sometimes explain, but it is always a poor substitute for learning from personal experience.

Permit me now some predictions about future research on the anatomy of the cardiac conduction system. I have already emphasized the need for more cross-

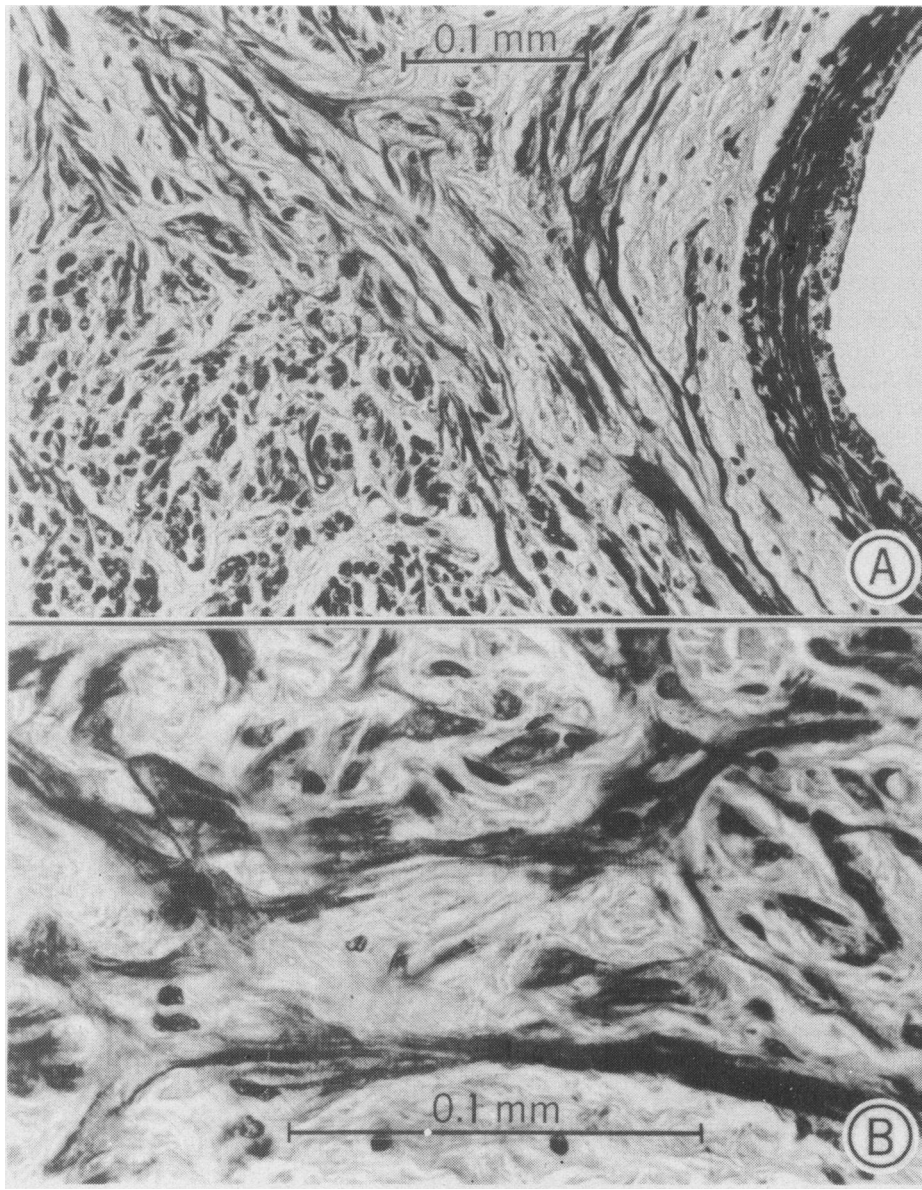


Figure 8.

The variety of cells typical of the human sinus node is illustrated here at two magnifications. All tissue shown is sinus node, and a portion of the central artery is seen at the right margin of A. Collagen is light grey, and contains an interweaving meshwork of darker nodal cells of two principal kinds: a slender one containing numerous myofibrils (transitional cells) and an ovoid pale cell with very few intracellular organelles or myofibrils (P cell). See also Figure 9.

disciplinary work, not by teams but by individuals. Or as any medical student might put it, where is Purkinje now that we need him?

In anatomy particularly there is likely to be some redirection, a change from reductionist to holistic research. Don Fawcett admitted that vigorous exploration of the cellular and molecular levels of organization can accelerate our understanding in the short term, but then cautioned: "the frenetic effort to reduce all biology and medicine to physics and chemistry loses sight of the fact that our ultimate concern is the understanding of the whole organism. Eventually we will have to work back up from the molecular level and from the simplest organisms to higher levels of organization and to higher animals".[4] And dare I add, to man himself.

Let me illustrate this point from personal experience with the sinus node of Keith and Flack. There are remarkably important differences both anatomically and physiologically between the human sinus node[38-40] and that of the bat,[41] rabbit,[42] cow[43] and dog[44] but few pay attention to these differences. Furthermore, there is a variety of totally different cells within the sinus node (Figures 8 and 9), it has an intriguing centrally located artery (especially in man and the dog), and its function is profoundly influenced by the richly abundant nerves there.[45, 46] There is no way fully to understand sinus rhythm of the heart by studying separate cells in the sinus node without realizing how they relate to each other. There is no way to explain nodal function without carefully considering its innervation or its conspicuously prominent central artery. In short, intracellular fine structure and transmembrane flux of ions are all very fine to know, but one is still faced with the inescapable fact that the sinus

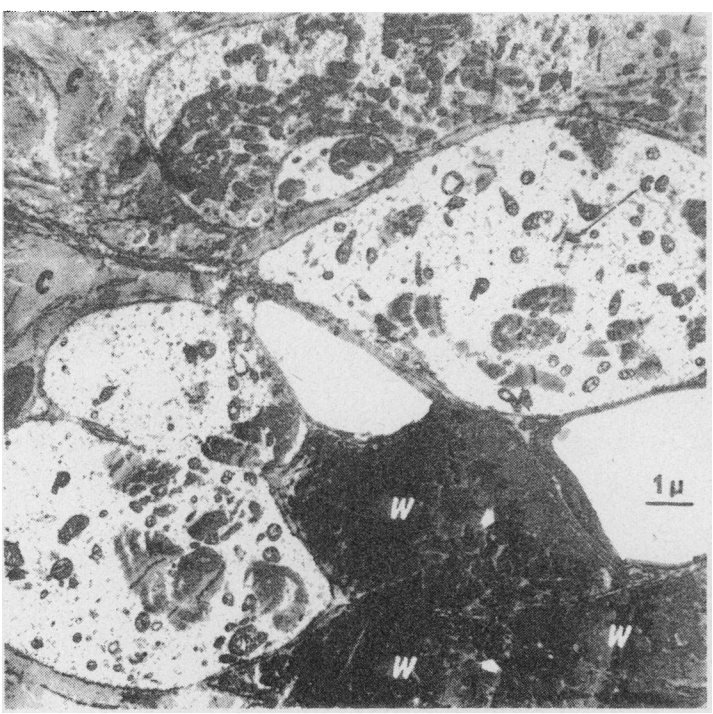


Figure 9.
This electron micrograph of canine sinus node was prepared from a specimen fixed in vivo by selective perfusion with glutaraldehyde. The contrasting appearance of P cells (P), transitional cells (Tr) and working myocardium (W) is demonstrated. C marks collagen fibrils and ce is a centriole. Small arrows indicate mitochondria which differ in complexity in the different types of cells.

node is a complex and heterogeneous multicellular biologic unit, the ultimate integrated function of which in vivo is markedly dependent upon its innervation and blood supply. Someone has said that what we truly need is more complexifiers and fewer simplifiers. Albert Einstein put it this way: "Everything should be as simple as it can be, but not simpler".

Occasionally, and not often, I am glad to say, I hear remarks that Keith and Flack's sinus node was only an anatomical curiosity until the physiologists "proved" its functional importance. Let me remind those making such remarks that the work of Gaskell and other stellar physiologists was largely at an impasse until the anatomical discoveries of a muscular bundle connecting atria to the ventricles, and of a peculiar mass of twisted, richly innervated fibres at the atriocaval junction, a newly recognized structure which could immediately be suspected to be the origin of the heart beat. It was only after those anatomical discoveries that knowledge about cardiac rhythm and conduction took a quantum leap forward.

Science will surely be better served if those in both fields heeded Robert Campbell's first dictum of medical teaching and more readily admitted their need for each other. Anatomists must be more ready and willing to conduct physiological studies. Physiologists just as obviously need to know, personally and first-hand, more about the anatomical structure of any tissue they are studying. Breaching these artificial barriers between intellectual disciplines should not be looked upon as a scientific sin but as a triumph for truth.

For those misguided sceptics who have been too ready with an epitaph for anatomy, listen to a small homily from my friend and fellow student of the sinus node, Reginald Hudson.[47] "If you are like me, you will often feel bewildered by the contradictory findings about medical mysteries, emanating not only from conscientious investigation but also from the sort of second-hand research done by punch-card and computer. May I therefore leave you with this piece of advice. It was given by a sergeant who was instructing a batch of recruits in map-reading. He said "if there is a discrepancy between the map and the ground you can take it as a main rule that it is the ground that is correct!".

A Czech born in Bohemia, a German born in Switzerland, a Japanese working in Germany, and an Englishman born in Scotland, come together in a marvellous international panorama of the anatomical history of the conduction system of the heart. There have been many others of course, and I must apologize if I have omitted any of your own favourites.

Johann Wolfgang von Goethe, Purkinje's intercessionary benefactor, has written: "One ought, every day at least, to hear a little song, read a good poem, see a fine picture, and, if it were possible, to speak a few reasonable words". My own words today are to honour the memory of Robert Campbell, a man whom the German poet's thoughts fit so well.

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THOMAS CARNWATH

by

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THE Queen's University received a benefaction from Mrs. Carnwath and her family in 1955 to provide prizes in social and preventive medicine in memory of her husband, the late Dr. Thomas Carnwath. These awards originally took the form of a medal and book prize for the student gaining the highest place in the final part one examination in social and preventive medicine, a book prize for the student gaining the next highest place and a medal and book prize for the graduate gaining the highest place in the D.P.H. examination. Medals were first given in July 1956, the undergraduate medal being awarded to Ingrid V. Allen, now professor of neuropathology and the graduate medal to Dr. Peter Froggatt, now Vice Chancellor and President of Queen's University*. Since the change in title of the Department of Social and Preventive Medicine to the Department of Community Medicine in 1976, the undergraduate medal currently is awarded to the student placed first in community medicine at the end of fourth year and no graduate medals have been given since the D.P.H. course was suspended in July 1972. The latter situation may change now that community physicians are examined by the Faculty of Community Medicine of the Royal College of Physicians of London.

This is a brief account of the life and work of Thomas Carnwath (Fig. 1), one of Queen's most distinguished medical graduates.

BACKGROUND AND TRAINING

Thomas Carnwath was born on 7th April 1878 in Strabane, county Tyrone, the youngest son of Joseph and Mary (neé Porterfield) Carnwath who had a family of six boys and two girls. The Carnwaths were of Scottish origin and came to Ulster in the seventeenth century probably from the village of Carnwath, Lanarkshire, which is south-west of Edinburgh on the road to Lanark. The name is uncommon in Northern Ireland and, for example, was not listed by Sir Robert Mathewson[1] in his analysis based on surnames having five entries and upwards in the birth indexes of 1890 maintained by the general register office in Dublin. Also the surname is not included in MacLysaght's more recent publication.[2] County Tyrone was planted by James Hamilton and a fellow scot, James Fullerton from 1587 onwards.[3] Officially

*The Carnwath medal for undergraduates has been awarded annually since 1956. The recipients from 1956 to 1981 were respectively: Ingrid V. Allen, Grace E. Allen, Columba A. Gorman, Norman C. Nevin, William Thompson, Samuel R. Keilty, Michael E. Scott, Donal A. J. Keegan, Robert J. Stuart, Peter G. Nelson, Helen Mawhinney, Arthur J. Robinson, Samuel G. Carruthers, Jocelyn R. Corbett, Robert E. Henderson, Patricia C. A. Shepherd, Hugh McA. Taggart, Moira Hill, Allister J. Taggart, Helen W. A. Calvert, Margaret E. Cupples, John T. Lawson, Dora E. Stelfox, Bernadette M. Cullen, Kenneth A. Larkin, Mary G. O'Hara.

The Carnwath medal for the highest place in the D.P.H. course was awarded in 1956, 1959, 1960, 1961, 1962, 1964, 1966, 1968 and 1970 to the following: Peter Froggatt, Olumide A. Lucas, Peter C. Elwood, Roger Blaney, B. Claire, C. Davison, Jean H. Jolly, Bahshish M. Singh, Rosemary Meyers, James G. McC. Johnston.

Fig. 1.
Thomas Carnwath, D.S.O., M.B., D.Sc.
photographed in 1935.

no undertaker was allowed to get more than 2000 acres and others were to receive 1500 acres or 1000 acres but this system was greatly abused with some parties obtaining much less and some much more land. It is known that Andrew Carnwath settled in the townland of Stoneypath, some four miles north-east of Strabane, around 1650 and farmed 1000 acres obtained during the plantation in the reign of James I. Andrew is recorded as an elder of Donagheady (17th century spelling Donagheadie) Presbyterian church which was established in 1658, with the first incumbent from 1672-1700 being the Reverend John Hamilton. A second church was built in 1855 and during this century the congregations of First Donagheady and Second Donagheady Presbyterian churches were amalgamated so that the present building is that erected in 1855 and the original (first church) is now demolished. Thomas Carnwath's early schooling was in Strabane and then at Foyle College, Londonderry. He entered Queen's College, Belfast as a matriculated student of the Royal University of Ireland in October 1896.

Prizes soon followed and included first and second year scholarships in medicine in 1897-98 and 1898-99, a scholarship in chemistry in 1900-01 and one of two Dunville studentships which were awarded in alternate years for physical science and biological science respectively. Primary degrees of B.A. (with honours) in chemistry and physiology were obtained in 1900 and M.B., B.Ch., B.A.O. (with honours) in 1903. His outstanding abilities in both science and medicine led him to take up the post of demonstrator in anatomy from 1903-04 under Professor J. Symington while at the same time being senior scholar in chemistry in Professor Lett's department where he completed the prescribed course in this subject required for the D.P.H. of Cambridge University. Dr. Carnwath also took a special course in bacteriology in 1904 under Professor Lorrain Smith (late of Queen's), head of the Institute of Pathology of Victoria University, Manchester.

By now Thomas Carnwath was firmly committed to a career in public health and was nominated by Queen's College for an 1851 exhibition. He was appointed a bursar for 1904-05 and a scholar for the following years 1905-07. At that time, as at present, these scholarships were highly competitive and prestigious awards. They owe their existence to a surplus of money remaining after winding up the affairs of the Great Exhibition of 1851.[4] The Commissioners for this Exhibition realised that this event would yield substantial profits and with additional voluntary subscriptions a guarantee fund of over £300,000 was created. The Commissioners led by the Prince Consort considered the educational needs of the country would be best served by providing a locality to foster multi-disciplinary interests for industrial education of potential benefit to the whole nation. Some eighty-seven acres at South Kensington were purchased at a cost of £3500 per acre, and during the ensuing years this estate was laid out to include, amongst others, such national institutions as the Victoria and Albert Museum, the Royal College of Science, the Royal College of Art and Imperial College. Around 17 to 20 scholarships for scientific research were awarded annually from 1891 onwards and university students from the United Kingdom, the British Empire, the Commonwealth and other countries formerly linked with the Empire were eligible to apply. Between 1891 and 1979, 1170 scholars have been appointed, of whom 118 became Fellows of the Royal Society, eight Nobel Laureates and five have received the Order of Merit. One of the first scholars was the famous physicist Ernest Rutherford, born in Nelson, New Zealand in 1871,

who obtained an exhibition in 1894 to study at Trinity College, Cambridge and the Cavendish Laboratory. Dr. Carnwath's nomination for an 1851 award states that his proposed research was to be in the fields of bacteriology and chemistry relating to the bacterial flora of shellfish and their association with sewage pollution in Belfast lough.

POLLUTION IN BELFAST LOUGH

The growth of industrial cities during the Victorian era was accompanied by serious health hazards due to environmental pollution. All large centres in the British Isles were affected as also were cities in Europe and North America. The major problem was the discharge of ever increasing amounts of untreated sewage into rivers and estuaries. In 1898 the Government appointed a Royal Commission "to inquire and report what methods of treating and disposing of sewage (including any liquid from factory or manufacturing process) may be adopted". The Commission chaired by Walter Stafford, Earl of Iddesleight, sat for 16 years and produced nine exhaustive and detailed reports together with a final report containing their summary, conclusions and recommendations.[5] Of these reports four deal mainly with the purification of domestic sewage being discharged into streams (interim, second, fifth and eighth reports), two with the discharge of sewage into tidal waters (fourth and seventh reports) and three with the discharge of manufacturing effluents (third, sixth and ninth reports). One report,[6] the seventh, contains observations made at the request of the Local Government Board for Ireland with conditions arising in Belfast lough in particular. For this work medical officers of health throughout the British Isles were consulted, river estuaries inspected and sewage samples and specimens of flora and fauna were collected for later examination in the laboratory. In addition experiments were made into the effects of local tides moving effluent from discharge sites to more distant locations.

Much of the evidence relating to Belfast and other cities in Ireland presented to the Royal Commission was prepared by Edmund Letts and a number of colleagues including Thomas Carnwath who worked with him during the period from 1898 to around 1912. Albert Edmund Letts had succeeded Thomas Andrews as Professor of Chemistry at Queen's in 1879 following a four year period as the first Professor of Chemistry at University College, Bristol. As well as presenting his evidence to the Royal Commission he also undertook investigations of Belfast lough on behalf of the Belfast Health Commission.[7] The latter was appointed in 1907 by the Local Government Board for Ireland 'to inquire into the public health of the City of Belfast and to make recommendations for its improvement'. By 1900 Belfast was the eighth largest city in the British Isles and was growing at the rate of between 2 per cent and 4 per cent per year. The 1901 census population was 349,180 persons resident in an area of 14,716 acres. Death rates, especially from infections, were high and public health administration was fragmented. The most obvious problem however, and the one of greatest public concern, was the disposal of sewage.

Belfast had not wholeheartedly adopted the sanitary ideas enunciated by Edwin Chadwick[8] from 1832 onwards. Main sewers were laid down in some parts of the city but not in others. However, one of the main methods for sewage disposal was by a chute, approximately 4 ft. by 4 ft. in size, which came into operation in 1893 and discharged untreated material mainly at night into Belfast lough (Fig. 2). This chute was fed by a storage area capable of containing about one million gallons of raw

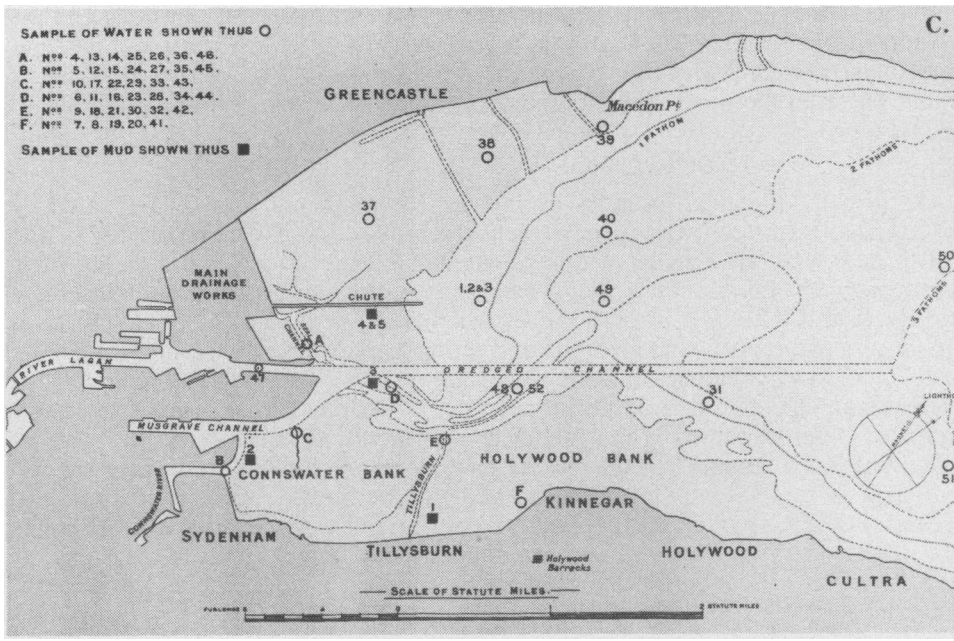

Fig. 2.
The sewage disposal system for Belfast indicating main drainage works and chute and location of samples of mud and water surveyed by Professor Letts and colleagues.

waste. By day sewage from the neighbouring industrial complex of Harland and Wolff which then employed 10,000 men drained untreated effluent directly into the river Lagan. In addition to this already overwhelming burden of pollution entering Belfast lough a new phenomenon occurred, namely the growth of large masses of a seaweed, *Ulva latissima* or 'sea-lettuce'. Reconstruction of the Belfast system of sewage was undertaken from 1887 to 1893 when the chute began to operate. This soon became leaky, often blocked, and discharged into shallow and sluggish water. On the slob lands of Belfast lough seaweed began to grow prolifically, particularly in areas where there were dense banks of mussels and other shellfish. By 1890 *Ulva latissima* covered nearly 2400 acres of slob land between the Musgrave Channel and Cultra (Fig. 3)[10] and the deposit on the shore at Holywood was 3 ft. thick. During the summer this putrefied and at low tide the stench was overpowering owing to the formation of sulphuretted hydrogen from the decomposing mess. After a storm enormous quantities were washed up on the shore around Holywood, Cultra, Carrickfergus and Whitehead with banks of rotting weed extending for miles along the coast. Wealthy residents were concerned not only about the appalling smell but also by the adverse effect on coastal property prices. Henry Harrison who owned a large stretch of coastline at Holywood employed a consulting engineer, Mr. R.I. Calwell, to examine aspects of this problem and presented his own findings to the Royal Commission in February 1910.

Dr. Carnwath meanwhile obtained the D.P.H. from Cambridge University in 1906 and had travelled to Germany to further his research on the problem of estuary pollution. He worked under Professor Dunbar, Director of the Staatlichen Hygienischen Institut, Hamburg, from May 1906 until January 1907, and from then until his return to England under Professor Uhlenhuth at the Kaiserlichen Gesundheitsamte, Berlin. Germany at that time was the mecca for aspiring physicians, the most influential figure being Robert Koch, Director of the Institute of Health in Berlin, who received the Nobel Prize for Medicine in 1905 in recognition of his work on tuberculosis and other infections. Dr. Carnwath, as well as being medically qualified, was a gifted linguist and could pass for a German citizen. His 1906-07 papers written in german deal with several topics. The first[11] describes an investigation conducted under the direction of Professor Uhlenhuth into an outbreak of an illness in hens kept by the bacteriology department of the Ministry of Health in Berlin. They suffered from a diphtheria type condition, restricted to the mucous membranes of the head, diagnosed as due to the organism causing chicken diphtheria. By innoculating healthy hens with isolates of the causative agent, Dr. Carnwath demonstrated that this was identical with the organism which causes chicken-pox. A second paper,[12] also based on work with Dr. Uhlenhuth, relates to a micromethod for examining small traces of blood as required in forensic practice. The third paper[13] written with Dr. Kammann is an extensive account of an intermittent ground filtration method for treating sewage. The oldest technique used in Germany and the rest of Europe until the 1880's was to

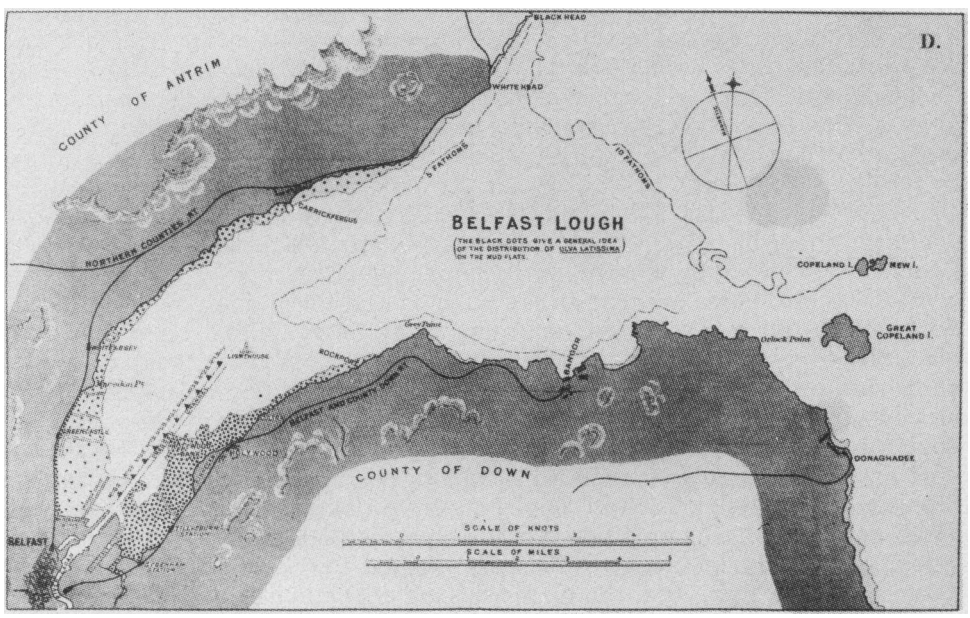

Fig. 3.
Map of Belfast lough indicating 2400 acres of foreshore covered by growths of the seaweed Ulva latissima *(sea-lettuce).*

spray the surface of the land with sewage waste and allow weather and the soil to take their natural course. There is nothing wrong with this technique except that one hectare (2.5 acres) of land is required to handle waste from around 500 persons. The limiting factor is the natural filter created by the spaces between soil particles; for example, if this is blocked by spreading too much sewage on the surface of the ground an irreversible situation occurs resulting in this particular land being useless for many years. Numerous attempts were made to improve on nature and in the town of Lawrence, Massachusetts, an experiment showed that one hectare of land might handle waste from up to 3000 persons. If the soil surface is coated with a layer of coal or slack which act as oxidising agents, waste from 50,000 persons can be treated per hectare; an even better filter is produced by using coarse sand. Dr. Carnwath's paper describes the effects of using gravel or sand filtration with different particle sizes, the importance of a rest period for filter beds of at least three days between treatments of batches of sewage, and the effect of temperature on the nitrification process. This is very important as during winter one complete cycle of nitrification may take up to three months compared with between seven to eight days in summer. Serious problems arise when snow and ice cover the ground because the surface of the filter cannot be cleaned and raked. Experiments were made in laboratories in Germany by Dr. Carnwath and also with Professor Letts in Belfast to determine whether the growth and subsequent breakdown of seaweed were primarily influenced by chemicals or bacteria in sewage effluent. They demonstrated that *Ulva latissima* grew abundantly owing to the high nitrogen content, in the form of ammonia and nitrates, in the polluted seawater of the lough, that lack of oxygen exacerbates the putrefaction process and that a biological filtration method for treating sewage is required because mechanical or absorption methods on their own are inadequate. Letts further showed that a satisfactory effluent for Belfast needed to contain a minimum of organic matter as well as a minimum of ammonia and of nitrates. This was possible by combining bacterial treatment with denitrification, a process whereby free nitrogen gas is produced by the reduction of nitrates or nitrites by chemicals or bacteria. However, what was to be done about the tons of seaweed already polluting Belfast lough? By 1909 the City Surveyor, Henry A. Cutler, and two members of his staff, Colin C. Frye and G. Bertram Kershaw, together with Edmund Letts began experiments whereby one hundredweight of copper sulphate crystals was distributed over one acre of polluted slob land at low tide.[14] The copper sulphate was carried in buckets and applied by hand. Within three weeks the seaweed had turned brown and became detached from its anchorage, usually underlying beds of mussels. Other cheaper chemicals, including sulphuric acid, bleaching powder, caustic soda and quick lime, were tried in November 1909 but none was as effective as copper sulphate. By 1910 a major offensive began; the dose of chemical used was increased to 182 lbs per acre and between 3rd and 5th May some three tons of copper sulphate were sprinkled over the foreshore with another nine tons being used between 8th June and 26th July. The cost including labour was £2. 11s. 0d. per acre. The next step was to clear the dead seaweed and mussels using gangs of men who loaded this material into barges and dumped it in the area of the lough where the Harbour Commissioners were forming an embankment.

The Belfast Health Commission report is a landmark in the improvement of the public health of the city because items so long neglected, and yet shown to be

essential by Chadwick and others many years previously, were seriously tackled. The water supplies from Woodburn and Stoneyford catchment areas were provided with larger filtration beds of sand, bacteriological control of water after filtration was instigated, and plans were laid to develop the reservoirs in the Mourne mountains. Collection of shellfish for food from the mussel beds in Belfast lough was prohibited owing to the frequent outbreaks of typhoid and dysentery, larger sewage works were planned and reclaimation of the slob lands in front of the mouth of the river Connswater and within the limits of the city was proposed. Lastly, the work of the Belfast Public Health Commission and the Medical Officer of Health and his staff were restructured.

ENGLAND AND NORTHERN IRELAND

Dr. Carnwath took up the first of many posts in England in 1907 as assistant physician at the Infectious Diseases Hospital, Salford. Appointment as assistant medical officer of health, Manchester, followed in 1908 and in 1910 he became a medical inspector for His Majesty's Local Government Board and lecturer in public health at St. Thomas's Hospital, London. Dr. Carnwath served as a territorial force officer in the Royal Army Medical Corps from 1912 and was mobilized on the outbreak of war in the summer of 1914. He joined The Honourable Artillery Company as medical officer to the first battalion of one thousand men which reached French soil at St. Nazaire on Sunday, 20th September. Following fierce action at Ypres in June, 1915, Colonel Triffry of the 1st H.A.C. wrote this tribute[15]

> "During this action no one behaved with more steadfast courage or showed a greater devotion to duty than our Medical Officer, Captain Carnwath. He had his aid post in our original front line and from the time of the first assault when the wounded commenced to come in, in fact even before that time, he was at his post and remained there all through the 16th, all through the night of 16-17th, and all through the 17th, on the latter day searching about for any who might have been overlooked and wanted aid. His unit had been relieved and gone down but he still carried on until no further wounded could be found. This had been the spirit in which Carnwath had worked ever since the Battalion came out and I am sure all ranks of the H.A.C. will agree that no more sympathetic, human or devoted medical officer was ever attached to a unit".

In January, 1916 Dr. Carnwath was transferred to Salonika to set up field medical laboratories because many of the sources of drinking water had been poisoned deliberately. Whilst serving as a captain in General Milne's campaign he became seriously ill from dysentery and other infections, and at one point was given up for dead; he was later sent to Malta to recuperate for six months before returning by sea to London. During his military service Dr. Carnwath was mentioned four times in dispatches and received the D.S.O. at Buckingham Palace on 6th April, 1918.[16] Dr. Carnwath was demobilized on 16th May, 1918 and transferred to the Territorial Force Reserve. Appointment to a T.A. commission in the R.A.M.C. followed on 3rd August, 1920 until he resigned on 28th March, 1922.

Sir John Simon had proposed a central co-ordinating health department for the whole country in 1854. By 1871 there were 11 government headquarters medical staff available to advise the Ministry of Health and local authorities.[17] In 1914 this figure was 43 and in 1918 there were 46 such individuals. The Ministry of Health was established by Parliament passing the Ministry of Health Act in 1919 following public concern about outbreaks of disease after demobilisation of the Armies who fought in the Great War and the necessity of improving the health of child-bearing women and infants, the treatment of tuberculosis and the rehabilitation of war veterans. Dr. Carnwath began his career in the Ministry of Health by being appointed to the post of medical officer in 1919. At that time the chief medical officer was Sir George Newman and there were eight sections, each in charge of a senior medical officer and staffed by between four and fourteen medical officers and other persons. The sections were: I. General Health and Epidemiology, II. Maternity and Child Care, III. Tuberculosis and Venereal Disease, IV. The supervision of food supplies, V. General Practitioner Services, VI. Sanitary administration in relation to infectious disease, VII. Welsh Board of Health, VIII. Medical officers employed for special purposes. Dr. Carnwath joined the largest section covering General Health and Epidemiology which was supervised by Dr. G.S. Buchanan and had among his fellow officers Major Greenwood, later to become Professor of Epidemiology and Vital Statistics at the London School of Hygiene and Tropical Medicine. As well as assessing annually the state of the public health using historical, economic, social, epidemiological, biological and medical information, much work was concerned with setting up and administrating the medical organisations of central and local government. We take this for granted now and perhaps too easily forget the firm foundations laid down by these men and women prior to the introduction of the National Health Service in 1948. The annual reports of the chief medical officer from the 1920s through to the 1940s stress the need to put preventive medicine into practice and frequently quote examples from the experiences of pioneers such as Simon, Chadwick and Farr in England[18] and Frank in Germany.[19]

During the period from 1929 to 1935 on promotion to senior medical officer Dr. Carnwath was in charge of a section responsible for nutrition, food and drugs administration, London hospitals and water supplies. Dr. Buchanan by now had received a knighthood and was responsible for a section dealing with medical intelligence and infectious diseases. Nutrition in particular was an active and important topic as Professor Edward Mellanby and his wife were publishing their results of the role of vitamin D in the development of bone and teeth,[20] the associated diseases of rickets[21] and dental caries. This vitamin was prepared in pure form for the first time simultaneously in England and Germany in 1931. Tuberculosis due to non-pasturised milk consumption also was a big problem and the licensing of herds for the production of Certified and Grade A (tuberculin tested) milk began in England in 1926. Some idea of the amount of disease is given by the figure for tuberculosis notifications for 1929, some 74,820 persons in England and Wales and a death rate of 96 per 1000 population (based on 37,990 deaths in 37,606,000 persons at risk). Problems which are still with us today including food poisoning, contamination of food by metals such as lead from substandard canning processes and adulteration of milk, alcoholic drinks and drugs took up considerable resources together with more esoteric illneses as for example, food poisoning from

polluted mussels and oysters. Billingsgate market in London retailed 10,000 tons of shellfish in 1920 and 344 tons were condemned by the officers of the Fishmongers' Company. Addition of chlorine to sea or fresh water to kill bacteria was pioneered in England by Sims Woodhead in 1897 at Maidstone, Kent, following an outbreak of typhoid fever (he added bleaching powder to the public water supply and stopped the epidemic) and this method was adopted both for sources of drinking water and also for cleansing shellfish in specially constructed tanks. These were introduced at Conway in North Wales by the Ministry of Agriculture and Fisheries and were a great success. However as they were located in the sea estuary their value became limited in future years due to increasing pollution so that many authorities, including Belfast, eventually banned the collection and sale of mussels and shellfish from local loughs.

After a long and distinguished career Sir George Newman retired in 1935 to be succeeded by Sir Arthur MacNalty and in that year Dr. Carnwath was promoted to the post of deputy to the chief medical officer. Again, the new chief medical officer in the introduction to his annual report for the year 1939 selected as his theme "the new and wider interpretation of preventive medicine". Following a summary of progress in infectious disease control, Sir Arthur applies the new scientific findings on nutrition towards the practical problem of the diet of the people. The advisory committee on nutrition appointed in 1931 was reconstituted in 1935 under the chairmanship of Lord Luke and their work assumed increasing importance with the pending outbreak of the Second World War in 1939 and the necessity of food rationing. During these years at the Ministry Dr. Carnwath also acted as an examiner in public health at the Universities of Birmingham, London, Manchester and Belfast, as well as being a member of the executive committee of the Bureau of Hygiene and Tropical Diseases, the Army Hygiene Advisory Council, the Board of Studies in Hygiene and Public Health of the University of London and the Joint Board of the Royal Sanitary Institute's and Sanitary Inspector's Examination. He was given the honorary degree of Doctor of Science by his alma mater on 10th July 1935; Professor Carnwath, dean of the Faculty of Science, presented Thomas Carnwath and another distinguished Queensman, Major-General William McArthur, deputy director general of Army Medical Services, to the Vice-Chancellor, Mr. Ogilvie, on that day. Following the outbreak of war in 1939, Dr. Carnwath spent many nights at the Ministry of Health leaving his wife, Margaret, alone at home. Mrs. Carnwath had suffered from severe and crippling arthritis over many years and by 1940 the situation was most difficult. Dr. Carnwath therefore decided to retire at age 62 years from his post as deputy chief medical officer. His successor was a close friend and colleague Sir Weldon Dalrymple-Champneys. Sir Arthur MacNalty also retired early in 1940 to be succeeded by Sir Wilson Jameson as chief medical officer for a period of 10 years and then by Sir John Charles in 1950.

Dr. Carnwath returned to Ulster to live at Cragside, Whitehead, County Antrim.[22] This house had been built in 1937 by Charlotte Despard[22] the well-known suffragette and socialist and a sister of Field Marshall Lord French, Lord Lieutenant of Ireland. His medical work continued unabated and at the request of a special committee of the Belfast Corporation he made an investigation of the city's municipal health services in 1941. In addition he chaired a committee enquiring into salaries and conditions of service of nurses in mental hospitals in Northern Ireland in 1944.[23, 24]

At this time the Province was debating the introduction of a national health service and there were a number of committees examining various aspects of this question. The services provided by Belfast Corporation were being assessed by a committee, locally known as 'the big six',[25] while the Government of Northern Ireland had set up a select committee to examine the health services. Dr. Carnwath presented extensive evidence[26] based on his experience at the Ministry of Health in England and Wales to this latter committee. In 1942 he was elected a convocation member of the Senate of the Queen's University and was also approached to accept nomination for a vacancy in the Senate of the Parliament of Northern Ireland; he later withdrew in favour of the official Unionist Party candidate.

Dr. Carnwath died at his home in Whitehead on 2nd April, 1954.[27, 28, 29] He was survived by his wife, Margaret Ethel, daughter of the late Andrew McKee of Belfast whom he married in 1908, and two sons Andrew and Douglas. A memorial service was held in the Presbyterian College Chapel, Belfast, conducted by Rev. W.F.S. Stewart, Minister of Whitehead Presbyterian Church. Thomas Carnwath's name is preserved by the generous endowment by his family to the Medical Faculty of Queen's. He is remembered as a most kind and friendly man of great strength of character and charm. His strong family roots in county Tyrone and sound undergraduate training in Belfast prepared him well to occupy some of the most responsible medical positions in the country. He gave freely of his experience and ability on numerous public bodies, committees and commissions and his life and work of service to the community stand as a lasting memorial.

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THE EFFECT OF BREWERS YEAST CONTAINING GLUCOSE TOLERANCE FACTOR ON THE RESPONSE TO TREATMENT IN TYPE 2 DIABETICS. A SHORT CONTROLLED STUDY

by

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TRIVALENT chromium has been identified as an essential trace element in the maintenance of normal carbohydrate metabolism, both in man and in animals. Its deficiency leads to an impairment of glucose tolerance which is reversed when the diet is supplemented by chromium salts, and more rapidly by foods with a high organic content.[1]

The absorption of chromium depends upon the chemical form in which it is present. The active principle 'glucose tolerance factor' (GTF) is present in a variety of foods including liver, meat, cheese and whole grain. GTF fulfils the criteria of an essential micronutrient more closely than simple chromium salts. Its gross composition appears to be a complex with niacin and amino acids. The richest known source is brewers yeast but the synthesis of pure GTF has not yet been completely successful. GTF is rapidly absorbed and biologically active chromium potentiates the action of insulin on the peripheral receptor sites.[2]

Inorganic chromium salts have been used in the treatment of human diabetics and good results have been reported in some, but not all, instances. More recently administration of GTF in the form of brewers yeast has been tried with some success. The subject still remains in the exploratory stage, with a lack of controlled studies and of a pure active complex for chemical testing. The present hypothesis is that impaired glucose tolerance in good responders may be related to insulin resistance associated with nutritional chromium deficiency.[3]

In view of the increasing interest in this subject and the apparent importance of geographical location, we felt a short preliminary double blind cross over study with brewers yeast and a placebo might be helpful before setting up a more extensive trial. We limited the sample to Type 2 diabetics who might reasonably be expected to have insulin resistance rather than an absolute deficiency. In addition to standard parameters of diabetic control which have been the subject of previous reports, (fasting blood glucose, the glucose tolerance test and the serum cholesterol and triglyceride levels), we were particularly interested to see if any beneficial effect might occur in the levels of glycosylated haemoglobin (Hb A_{1c}) and high density lipoprotein (HDL).

METHODS

Thirty seven non insulin-dependent diabetics (18 male/19 female) were studied as outpatients. The mean age of the group was 64 ± 1.6 years (mean ± S.E.M.), duration of diabetes 7.0 1.0 years and the percentage of ideal body weight ranged from 105 to 120 per cent. All the subjects were treated with diet and a sulphonylurea derivative. Treatment was kept constant for three months prior to the trial and throughout the trial itself.

After informed consent had been obtained, patients entered the random-order double blind cross over study. The trial consisted of two successive 7-week treatment periods during which existing treatment was supplemented with either brewers yeast (as a source of GTF) or placebo. Two opaque capsules containing either 200 mg of brewers yeast or a cellulose placebo were taken four times daily before meals. The chromium content of the yeast was 0.8 ug/g so that during active treatment subjects ingested an additional 1.28 ug of organic chromium daily.

Fasting blood was withdrawn from an antecubital vein prior to treatment and at the end of each treatment period. Plasma glucose concentration was measured by a glucose oxidase method on a Techicon Autoanalyser II.[4] Percentage haemoglobin A_{1c} (Hb A_{1c}) was determined by column chromatography.[5] Serum cholesterol and triglyceride were estimated using an automated enzymatic system.[6] HDL concentration was estimated after precipitation of LDL and VLDL with manganese chloride,[7] and the supernatent measured for cholesterol by the standard technique. In addition, subjects underwent an oral glucose tolerance test 50 g load (OGTT), before the trial and at the end of each treatment period. The area under the curve of the OGTT was calculated by manual counting of squares.

The initial values and the values observed after the placebo and active treatment periods are shown in Table I. The values observed after treatment were compared with the initial values using analysis of variance. which was performed at the Queen's University of Belfast Computing Centre.

TABLE I

Effect of 1.6g brewers yeast (GTF) daily compared with placebo on blood glucose Hb A_{1c} and serum lipids after 7 weeks treatment.

	N	*Initial*	*Placebo*	*GTF*
HbA_{1c}%	37	8.0 (± 0.3)	7.5[a] (± 0.3)	6.6[b] (± 0.2)
Fasting blood glucose (mmol/l)	37	9.2 (± 0.5)	9.0 (± 0.7)	9.1 (± 0.7)
Area under GTT	37	29.3 (± 1.4)	29.3 (± 1.4)	29.1 (± 1.3)
Triglyceride (mmol/l)	24	1.4 (± 0.2)	1.6 (± 0.2)	1.5 (± 0.2)
Cholesterol (mmol/l)	26	5.7 (± 0.2)	5.8 (± 0.2)	5.7 (± 0.2)
HDL (mmol/l)	13	1.1 (± 0.1)	1.2 (± 0.1)	1.5[c] (± 0.1)

Results are given as mean and (± SEM)

[a] $p < 0.001$ placebo v initial

[b] $p < 0.001$ GTF v placebo

[c] $p < 0.05$ GTF v placebo

Statistical significance by analysis of variance

RESULTS

Hb A_{1c} levels reduced from 8.0 ± 0.3 per cent to 7.5 ± 0.3 per cent during placebo treatment ($p < 0.001$). Active treatment with GTP was associated with a fall in Hb A_{1c} to 6.6 ± 0.2 per cent which was significantly greater than that observed after placebo treatment ($p < 0.001$).

All subjects improved in the first treatment period irrespective of whether this was yeast or placebo. This could have been due to improved dietary compliance. In the 15 subjects who had placebo before yeast GTF Hb A_{1c} levels fell from 7.91 ± 0.42 per cent to 7.53 ± 0.30 per cent during placebo treatment, and fell further to 6.28 ± 0.31 per cent during active treatment. In the 22 subjects who received active treatment before placebo Hb A_{1c} levels fell from 8.14 ± 0.46 per cent to 6.91 ± 0.35 per cent during active treatment but rose to 7.56 ± 0.38 per cent during placebo treatment. These results confirm an order-of-treatment effect but suggest that active treatment can reduce Hb A_{1c} levels.

In GTF v placebo comparison, active treatment with GTF was also associated with an increase in HDL levels ($p < 0.05$).

Fasting plasma glucose levels, serum cholesterol, triglyceride levels and the area under the curve of an OGTT were unchanged after placebo and active treatment when compared with initial values.

DISCUSSION

The average daily intake of chromium has been estimated as approximately 60 ug with a range of 5-150 ug, but only 1 per cent of the inorganic form is absorbed as against 10-25 per cent of biologically active organic GTF. The minimal requirements of the latter are estimated 10-30 ug.[3] The body pool of chromium depends upon an adequate background level. Where the water supply (the main source of inorganic chromium) shows no detectable levels of chromium, tissue chromium levels are low and carbohydrate tolerance impaired.[8] The water supply source for Belfast contains 20 ug/1 chromium; the European Economic Community standard is 50 ug/1. It is possible that our subjects were relatively chromium depleted and would therefore be expected to respond favourably to dietary chromium supplementation. Even though poorly absorbed, inorganic chromium has produced beneficial effects after several weeks to months in diabetics where there is reason to consider the body stores were low.[9, 10, 11, 12] However, a double blind cross over study of inorganic chromium and placebo in younger diabetics (ages 28-47) failed to show improvement in glucose tolerance.[13]

Organic chromium complex in the form of brewers yeast has been shown to improve glucose tolerance,[14, 15] but these studies included no placebo treatment period for comparison. Large quantities of brewers yeast must be ingested daily to ensure adequate amounts of GTF. Previous studies have used 5-10 g daily.[14, 15] This creates a problem of patient compliance, which is difficult to check as plasma chromium levels are only slightly increased during chromium supplementation.[11] In an attempt to overcome these difficulties a single blind study in elderly subjects, both normal and diabetic, compared the effect of 9 g of brewers yeast against chromium poor torula yeast given in orange juice over an eight week period.[16] Glucose tolerance improved, insulin output decreased and cholesterol fell with brewers yeast; unfortunately difficulties in assay precluded reliable data for chromium studies.

Our own investigation has also been limited by an inability to assess the chromium status with accuracy. As yet chromium is a difficult element to determine reliably[17, 18] and the spread of mean value reported for chromium in the serum is very large 0.14 to 782 ng Cr ml. We were unable to obtain a brewers yeast with a high chromium content and were advised a torula yeast might be toxic. A double blind trial is limited by patients conforming and a dosage of eight capsules daily was considered as acceptable. Our study with small amounts of organic chromium over a seven week period nevertheless suggested a beneficial effect on two important parameters of diabetic control not previously reported on, namely the HDL and Hb A_{1c} levels. The discrepancy between the fall in Hb A_{1c} values and the lack of change in fasting blood glucose value requires comment. The correlation between these two parameters of glucose control is accepted as approximately $r = 0.75$ in Type 2 diabetics.[19] Single fasting blood glucose estimates are subject to fluctuation and depend on patient co-operation in the immediate period before the test, and close supervision in this period as with inpatients might have given a more reliable correlation. The Hb A_{1c} results may therefore have been a better index of glucose control under the outpatient conditions of our trial. The correlation between Hb A_{1c} values and the oral glucose tolerance is accepted as poor and does not negate our findings. The latter estimates the response to an artificial glucose load and the former the average daily blood glucose level over a 4-6 week period.[20]

In spite of its limitations the present study is confirmatory that organic chromium may be of value in Type 2 diabetes. Hb A_{1c} levels of 12.6 per cent and above may be related to the microvascular complications of diabetes,[21] and so a reduction in this may improve the individual prognosis. It has also been suggested that chromium deficiency may have a role in insulin resistance and sepsis.[22] Chromium is still worthy of attention and research. Many of the present difficulties will be resolved when reliable and reproducible methods of chemical estimation become generally available, and the effects of more concentrated forms of organic chromium or GTF are subjected to clinical trials.

SUMMARY

Fasting blood glucose, the integrated area under a two hour 50 g glucose tolerance test, and Hb A_{1c} were measured in 37 Type 2 (non insulin-dependent) diabetics with maturity onset. Subjects were out-patients on diet and sulphonylurea therapy which remained unchanged. Estimations of serum cholesterol, triglyceride and HDL were completed in a proportion of patients. A double blind cross over study compared a placebo with glucose tolerance factor in the form of brewers yeast supplementation containing 1.28 ug chromium daily over a 7 week trial period. Treatment with brewers yeast (GTF) improved diabetic control as demonstrated by a fall in Hb A_{1c} per cent ($P < 0.001$) and a rise in HDL ($P < 0.05$). The local water supply is low in chromium at 20 ug per litre.

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CHILD ABUSE — WE MUST INCREASE OUR LEVEL OF SUSPICION

by

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CHILD abuse is often obvious. Occasionally, however its manifestations are not recognised or are easily overlooked. This paper describes three children to whom there was serious child abuse and in each there was a variable degree of diagnostic difficulty. The case reports are presented and comments offered which may help in the recognition and management of future cases. Several common adverse factors are referred to, the recognition of which may help to increase our suspicion of child abuse presenting with similar bizarre syndromes.

CASE 1

On the 3rd June 1979, this child, then 4 years old was admitted to a provincial hospital following a fall from a playground slide. He had a minor injury resulting in epistaxis and was discharged the following day. Two days later he was admitted again with epistaxis. On the 6th June he fell out of his cot, was not seriously hurt, but the following morning became drowsy and unsteady. On the 9th he was alert, but later that day had two generalised epileptic seizures culminating in status epilepticus. It proved difficult to abort the seizures and eventually the patient was paralysed with a neuromuscular blocking agent (d-tubocurarine) and intermittent positive pressure ventilation (IPPV) commenced. He was transferred to the Intensive Care Unit (ICU) of this hospital.

On admission the patient was very ill and collapsed looking but was no longer having seizures. The sytolic blood pressure was 50 mmHg and cardiac output was poor. The ECG showed a chaotic ventricular tachyarrhythmia with little evidence of atrial activity. Cerebrospinal fluid and routine blood analysis were normal. The symptoms and signs were thought to be caused by psychotrophic drug ingestion and accordingly intravenous physostigmine (5 mg in divided doses over 20 minutes) was given, but with little effect. Intravenous Practolol, 7 mg, was given and resulted in a return of sinus rhythm with improved cardiac output and more normal blood pressure.

On the 11th June the child was discharged to the provincial hospital, but the same day had two further major seizures and was readmitted to our hospital. He was conscious but irritable and aggressive; this behaviour persisted for several days.

Samples of urine taken on the 8th revealed elevated levels of imipramine (45 microg) and of its metabolite desimipramine (116 microg/1). Diazepam (153 microg/1) was also present; it had been used to try and control the seizures following his initial admission. A further urine sample on the 15th June following readmission from the provincial hospital revealed an even higher level of desimipramine (770 microg/1).

The family consisted of mother, father, sister aged 6 years and the patient. In 1975 when the patient was 3 months of age, the father sustained a total paraplegia following a serious motor cycle accident and has since been confined to a wheelchair. The family moved to England where the father's paraplegia was being managed. Subsequently, the mother developed episodes of depression and in July 1978 she was reported also to be drinking heavily. About this time she took an overdose of baclofen (Lioresil) (which had been prescribed for her husband) and gave large doses to both the patient (case 1) and his older sister, stating that she wished to kill all three of them. Between July 1978 and June 1979 the patient was noted to have numerous behavioural problems; language and speech development were also slow. It was thought that these were primarily related to domestic factors, particularly to emotional deprivation. The family returned to N. Ireland in July 1978 at which time we were informed of these events and local follow-up was initiated; the dramatic events described above took place 11 months later.

Comment

This child was given large abusive doses of the tricyclic antidepressant imipramine on at least two occasions which almost resulted in his death. The drug may be described as tablets of 10 mg or 25 mg. Following oral administration it is well absorbed, concentrations in the plasma reaching a peak within 2 to 8 hours but occasionally this may be delayed to more than twelve hours. The drug has a mean half-life of 13 hours and only a small proportion (< 2 per cent) is excreted in the urine.[1] Within a week most of the drug would be inactivated. Hence the higher urinary level found on 15th June, seven days following the first admission, strongly suggests that further amounts of imipramine had been given to the patient while he was in hospital. Close inquiry revealed that this medicine was not present in the drug inventory of the children's unit in which he was a patient at that time. It had, however, been prescribed for his mother by the family doctor shortly before the child's first minor accident on 3rd June.

It may be necessary to record visits and obtain further specimens from a child if it is suspected that drugs have been administered covertly. Such children might best be managed in an ICU where the ratio of patients to staff is more favourable; such children in an ordinary hospital ward may still be at risk from this potentially lethal form of child abuse.

CASE 2

This child was born on 5th September 1977 to an unmarried mother who first attended the Accident & Emergency Department of this hospital five weeks later, because the baby had developed a mild diarrhoeal illness. On 24th October, aged seven weeks, she attended again because on two recent occasions the child had vomited small amounts of fresh blood. On examination an erythematous lesion 5 mm in diameter, resembling a septic spot, was noted in the region of the right tonsil; there was a bruise 2 cm in diameter on the right cheek. Mother stated that she might have held the baby's chin too tightly while feeding him. The diagnosis was not clear, but recovery was rapid, no further bleeding occurred and he was discharged on 31st October. The same day the baby was readmitted with a similar history and some blood was observed in the mouth, pharynx and anterior nares. Bruising was

seen on the right fauces and on the left was a small ulcerated lesion. It was tentatively suggested that these may have been inflicted "as if by a spatula" but the truth was overlooked.

The baby was reluctant to feed, indeed he required gavage feeding as he seemed unable to swallow. A barium examination showed that swallowing movements were disordered; the passage of barium into the upper oesophagus was impaired and the mucosa within the pharynx and upper half of the oesophagus appeared to be thickened. The epiglottis was swollen and aspiration of some barium into the larynx occurred. By the 15th November (2 weeks later) the throat lesions had healed and further barium examination confirmed improvement in the swallowing mechanism and on the 22nd he was discharged

Later that same day, the mother returned to hospital with a similar history. Several small abrasions were noted within the oropharynx and an appointment was made for her attendance at a consultant's clinic the following morning. Atypical candidiasis, which had been the initial diagnosis, was again considered and an immune defect was now postulated.

However, later that same day (23rd November) she appeared yet again at hospital. Fresh cherry-red bruises were obvious on the lower gingival margin, beneath and on the upper surface of the tongue. These new lesions had not been present on examination earlier that day. In addition a moderately sized boggy tender swelling was noted on the left side of the head and the true diagnosis became obvious at last. A skeletal survey showed extensive bony injuries. In the skull there was much soft tissue swelling over the left parieto-occipital region, a long linear fracture running obliquely between the squamosal and sagittal sutures and a horizontal fracture running from this fracture line to the coronal sature. Some callus formation suggested that this had been present for several weeks. A healing fracture of the left radius at the junction of its mid and lower thirds was also found. Periosteal new bone formation was present extending up the medial aspect of the left tibia, although no actual fracture was visible.

The mother refused to cooperate in a psychiatric examination. A definite psychiatric diagnosis was not possible but she displayed some of the features of an immature personality. possibly combined with post-natal depression and psychopathic tendencies. Having repeatedly shown herself quite incapable of caring for the baby, he was fostered and after two years successfully adopted.

Comment

The true diagnosis of child abuse was made at 12 weeks of age. The injuries this infant received, estimated to be about six weeks old, dated from the time that his mother first began to attend hospital (12th October). At this time she had moved to Belfast following the child's birth elsewhere. The injury to his leg was possibly produced by tight squeezing of the leg. The injury to the left arm was likely caused by a direct blow, the pharyngeal injuries were possibly caused by repeated, firm trauma from a blunt instrument like a spoon. With hindsight it seems curious that for six weeks the true diagnosis was overlooked. The initial injuries were unusual, however, in being within the pharynx, rather than anteriorly in the region of the gingival margin, such as a tear of the frenulum. The latter is more common and

virtually pathognomonic of child abuse. This diagnosis was overlooked because the meaning of mother's repeated attendance at hospital was ignored. This type of behaviour should always alert one to this diagnosis, particularly when traumatic lesions of any sort are present.

CASE 3

This 3-month old boy was admitted in a moribund state to the ICU of this hospital on 16th January 1980. The previous day he had cried persistently and was seen by his family doctor who diagnosed "abdominal colic" and prescribed a mild oral antispasmodic. On the morning of admission he had developed left-sided seizures and when examined was exceedingly pale, had a bulging anterior fontanelle, bilateral retinal haemorrhages including a subhyaloid collection; a partial 3rd nerve palsy was noted on the right side. No cutaneous or oral bruising was found. Lumbar puncture revealed uniformly blood-stained CSF, but subdural collections were not present. A CT scan revealed a very swollen brain but excluded any form of intracranial haematoma. Skeletal x-rays uncovered no bone injuries. Although the infant was managed with IPPV and careful monitoring, he slowly deteriorated and died 8 days later. A forensic necropsy showed gross cerebral oedema and such was the friable condition of the brain that death had probably been present for several days. No other signs of injury were found.

This was virtually a single-parent family; the father who had given up his job was looking after this infant and three older sibs. He was receiving support and supervision from the local social services department. Each of the children were wards of court because of the mother's inability to cope. She was of Mediterranean origin and had often been admitted to a local psychiatric hospital because of severe depression and paranoid delusions which resulted in much pathological jealousy of her husband. Later it was revealed that the child's father had had occasional violent outbursts and once or twice had been in trouble with the police.

Comment

The presence of retinal haemorrhages, evidence of intracranial haemorrhage and cerebral oedema even in the absence of other signs of "battering," are highly suggestive if not diagnostic, of child abuse. Indeed the presence of retinal haemorrhage *per se* in children with head injury under 3 years of age is believed to be pathognomonic of this condition; the syndrome is caused by violent shaking. In other types of head injury retinal haemorrhages are most unusual.

Caffey in 1974[2] described what he termed "Whiplash Shaken Infant Syndrome," which results when an infant is held by the shoulders and shaken repeatedly. The weight of the infant's head and the relatively weak musculature of the neck contribute to the flailing acceleration—deceleration injuries produced during shaking. These forces may occur in different directions, hence damage may be produced in the brain at several sites. The pliable sutures and relatively soft skull with open fontanelles and ununited sutures predispose to tearing of blood vessels which are attached to more fixed structures such as the falx cerebri. Some of these injuries may resolve with minimal residual handicap to the child, but in 35-40 per cent there may be permanent neurological sequelae such as mental handicap, deafness or visual impairment. Mortality, as in this case, is thought to be high.

DISCUSSION

The cases presented with unusual clinical manifestations of child abuse and in each, recognition or acceptance of the diagnosis proved difficult. Case 2 was diagnosed only after several weeks of intensive investigation while in Case 3 the social services team, which had been involved, found it almost impossible to accept the diagnosis even following a thorough necropsy examination by an experienced forensic pathologist. Non-accidental poisoning (Case 1) is recognised also as presenting a major problem of diagnosis.[3, 4]

Two key factors were common to each family. Two of the families were being looked after by a single parent and the family of Case 1, by virtue of the father's handicap, was in a sense similarly disadvantaged. A high proportion of families in which child abuse occurs have only one parent. Clearly where little support is provided by other family members, support by the health caring agencies may be crucial.

Each infant had a parent with a serious psychiatric illness. Among abusing parents, one third of fathers have gross personality defects; neurosis, emotional immaturity, an abnormal and/or dependent personality and subnormal intelligence are not uncommon among mothers.[5] In a survey of 76 cases of child abuse and neglect in the Southern Health and Social Services Board, 50 per cent of the children had one parent with a psychiatric disorder or mental handicap. This is much higher than local estimates by the Northern Ireland Association for Mental Health, who calculate that approximately 11 per cent of the provincial population will at sometime be admitted to a psychiatric hospital for therapy.[6] The combination of psychiatric illness and severe restriction of family support must surely increase the risk of abuse even further. Booklets issued by the four area boards in 1976 outlining the procedure to be followed in cases of suspected child abuse, made no reference to the risks to the young from parents who are psychiatrically ill, nor of the steps to be taken either to prevent abuse, or respond to it. Indeed we are of the opinion that not enough consideration has been given by the profession of the risks to young children in families where there is psychiatric illness. This is emphasised by the findings of a recent committee of inquiry into the death of a child by non-accidental drowning at the hands of his very disturbed mother.[7]

In two of the cases social service departments were already involved with the families. Indeed in Case 1, child abuse had taken place about a year previously when the family were residing in England. With regard to the family in Case 3, it is disturbing that in spite of very close support, fatal abuse supervened. It is perhaps more worrying, however, that because of supervision being provided by local social workers that this team found it difficult once abuse occurred to accept the true diagnosis. It should be recognised that community support of this type may occasionally fail to prevent abuse or its recurrence. It must be admitted also that in Case 1, even the general level of hospital surveillance failed to prevent a disturbed, plausible and devious mother from administering drugs to her child in doses sufficient to produce serious, near-fatal symptoms while in a hospital ward.

CONCLUSION

These cases were selected to illustrate some of the diversity and difficulty in diagnosis of child abuse. This selection was made purely on the basis of a bizarre or

unusual presentation, which was thought worthy of comment. It is curious, however, that in each instance there was a striking interplay of adverse social factors, a single-parent family, and psychiatric disturbance in one of the parents with involvement of the social services department. A greater level of suspicion is still necessary in order to reduce the morbidity and mortality associated with child abuse.

SUMMARY

Three unusual cases are described which illustrate some of the diversity of presentation and difficulties in diagnosis of child abuse. The first is of non-accidental poisoning, the second presented with unusual oral and pharyngeal injuries and occult fractures and the third was a child who died of intracranial bleeding following severe shaking, but in whom there were no signs of overt trauma. In each case, adverse domestic and psychiatric factors were prominent; local social service departments were already concerned with two of the families. A review of the investigations and management of each case suggest that levels of suspicion are still too low among both the medical and social work professions. It must be emphasised that infants of mothers with serious psychiatric disorders are particularly at risk. Psychiatrists as well as family doctors and paediatricians have a definite role in prevention of child abuse.

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ADDENDUM

Since submission of this paper we have seen a further infant, aged 6 weeks, in whom similar findings to Case 3 were present. There were retinal haemorrhages and subarachanoid and extensive intracranial bleeding and several small bruises were present on the child's neck and upper thorax, greater on the left side than on the right, perhaps indicating that it had been grasped tightly and severely shaken by a right handed person. The child died a few days later. The mother admitted that this is what had taken place.

COCCYGECTOMY

A review of thirty-seven cases

by

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INTRODUCTION

COCCYDYNIA is a condition for which there are many forms of treatment. This is partly a reflection of the fact that coccydynia is a subjective complaint and therefore difficult to assess, indeed it can probably only be assessed subjectively. Coccydynia usually responds to conservative measures, but when these measures fail coccygectomy has been reported to be successful.[1, 2] However, it is our impression that some surgeons are still reluctant to recommend operative treatment for coccydynia. It was therefore thought worthwhile to undertake a further study of this operation to try to ascertain the results of operative treatment for coccydynia and especially to try to identify possible causes of failure.

MATERIALS AND METHODS

The records were obtained for fifty-two patients who had coccygectomy carried out at Musgrave Park Hospital, Belfast and Altnagelvin Hospital, Londonderry during the period 1969-1977. All patients were asked to attend for review in order to obtain their subjective evaluation of the effect of the operation upon the coccygeal pain. Those patients who did not attend were asked to complete a questionnaire. The charts were studied with reference to the length of time the patient had symptoms prior to surgery, whether there was any history of injury before the onset of symptoms, of any previous lumbar backache or any reference to abnormal mental behaviour. Details of any previous conservative treatment were also noted.

RESULTS

Thirty-two patients were reviewed and five completed a questionnaire. There were thirty-three women and four men, and the mean follow-up was 5.5 years with a range of one to nine years. The patients were asked to select from four categories giving their own assessment of the pain relief given by the operation. These categories were complete relief, improvement, no relief, and worse than before the operation. There were ten patients who found complete relief and 17 patients who found improvement following the operation, these 27 patients were categorised as having had successful operations. The six patients who had no relief and the four patients who were worse following the operation were all categorised as having had unsucccessful operations.

The age of the patients at operation ranged from 17 to 53 years with an average age of 34 years. Three of the 14 patients under the age of 30 had unsuccessful operations and seven of the 23 patients over the age of 30 had unsuccessful operations.

Requests for reprints should be sent to Mr. A. R. Wray.

In this series the period of time that patients had symptoms before operation varied from three months to 14 years with a mean of four years. Twenty-six patients had symptoms for less than four years, five of these has unsuccessful operations, whereas of the eleven patients who had symptoms for more than four years, five were unsuccessful.

Coccygectomy was carried out in only four male patients, two of whom had unsuccessful operations. One of these had a gunshot wound to the lumbar spine with referred pain to the coccyx. The other had increasing pain after his coccygectomy and was later shown to have a spinal tumour, which on removal led to the relief of all symptoms.

Although all patients had conservative treatment in the form of a rubber ring or baths, only eight had injection with manipulation and a further 12 injection alone. Coccygectomy was more successful in those patients who had not had prior injection or manipulation. Twenty-two of the 37 patients had a definite history of injury or a difficult childbirth immediately preceding the onset of symptoms. Nine of the ten patients who had an unsuccessful operation had had an injury. Lumbar backache was present before operation in 20 patients, four of whom had unsuccessful operations. Only seven patients had a reference to abnormal mental behaviour in their hospital records and in only one was operation unsuccessful.

Radiological examination was undertaken at review in 23 cases. It was found that in 11 cases the coccyx had not been totally removed. Three of these 11 had unsuccessful results compared to two unsuccessful results in the 12 who had a complete coccygectomy.

DISCUSSION

Coccydynia is a condition characterised by pain in the coccygeal area associated with local tenderness on rectal examination. Radiological examination is frequently normal. There are many theories as to the causation of coccydynia and these are divided into referred causes due to nerve root irritation in the lumbar region[3] and local causes including trauma to the coccyx, sacrococcygeal arthritis or strain of the ligaments attached to the coccyx.[4, 5] Although there are many theories suggesting causes, there is little factual evidence to prove these theories, though recently there have been two reports of glomus tumour in the coccygeal body being responsible for the coccydynia.[6, 7] It is this lack of evidence and the lack of objective measurement of coccydynia that makes it difficult to give clear indications for surgery.

Gardner[8] gave two indications for surgery (1) sacrococcygeal arthritis or (2) deformity of the coccyx and qualified this by stating that before surgical intervention pain should be resistant to all forms of conservative therapy and should be disabling in character. In this study only ten patients had radiological evidence of arthritis or deformity and seven of these patients were offered surgery without prior injection or manipulation because the surgeon considered that coccydynia due to these two factors was unlikely to respond to conservative measures. Twenty other patients were offered surgery because of failure of injection or manipulation. The other seven patients were offered surgery because they had their symptoms for so long (seven to fourteen years). In Northern Ireland, conservative measures in the form of advice, baths, rubber rings, injection or manipulation were generally prescribed before offering surgery. In a preliminary study of 53 patients who had been treated

for coccydynia in one orthopaedic clinic during the same period (1969-1977) as this study, only six eventually had excision of the coccyx.

In this retrospective study 73 per cent of patients had a successful operation. There were ten patients in whom the operation was a failure and it was these ten patients who were studied in greater depth to try to ascertain reason for failure. However, it was not possible to give clear contraindications to surgery, although several factors were of interest.

There is a feeling amongst some orthopaedic surgeons that coccydynia is predominantly a neurotic symptom. In this study of patients selected for operation, symptoms suggestive of psychoneurosis were infrequent and even in those patients where these symptoms had been noted, the operation was more often successful than not.

Although the overall figures show that the presence or absence of low lumbar backache preoperatively made little difference to the overall result, four of the failures had lumbar lesions with referred coccydynia. One was later shown to have a spinal tumour, two later had excision of prolapsed intervertebral discs and one a gunshot would to the lumbar spine. Low lumbar backache is a very common symptom and should not by itself be a contraindication for surgery, however if there are signs of lumbar root irritation then coccygectomy is probably not indicated.

The results of a postoperative radiograph have not been reported before. This examination was carried out at review because one patient in this study and one patient reported by Spence[9] noted that their coccydynia was not relieved by initial coccygectomy, but gained relief following a second operation with excision of a further segment of coccyx. It is not surprising that incomplete coccygectomy may be carried out when the anatomy of the area is so variable, with the coccyx consisting of three, four or five segments with a variable amount of fusion.[8] We did find it surprising that our figures showed that it made little difference to the success or failure of the operation as to whether the coccyx was totally removed or not. This again is a reflection of the paucity of real evidence as to the causation of coccydynia. Were it known that the pain was arising from the sacrococcygeal joint, the coccyx, or the ligaments attached to the coccyx, then we would be able to advise total coccygectomy or partial coccygectomy or simply release of the ligaments. Until then one must still advise a total coccygectomy. In this study three of the failures did not have a total coccygectomy. It is thought that the disturbance in these cases was in the sacrococcygeal joint itself and indeed this was confirmed by the radiographs of these three patients, taken at review, which showed sacrococcygeal arthritis.

If the four patients with referred pain and the three failures who had incomplete coccygectomy are eliminated, this leaves 27 successful cases out of 30—a success rate of 90 per cent which compares favourably with previous series where the failure rate was 11 percent.[1, 10, 11]

SUMMARY

Thirty-seven patients with coccydynia were treated by coccygectomy because conservative measures had failed or because they had arthritis of the sacrococcygeal joint or deformity of the coccyx. The operation failed to relieve pain in ten, four of these had evidence of lumbar root irritation and three had undergone an incomplete coccygectomy. There were only three failures among those patients in who strict criteria were followed in selection for the operation and in whom a total coccygectomy was undertaken.

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RIGHT SIDED AORTA ASSOCIATED WITH TRACHEO-OESOPHAGEAL FISTULA AND OESOPHAGEAL ATRESIA

by

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RIGHT sided aorta is a known association with tracheo-oesophageal fistula. In the Royal Belfast Hospital for Sick Children we would expect to see approximately three cases in ten years. The cases reported all presented during a 12 week period in 1981.

Case 1

Born at 40 weeks gestation, weight 2.46 kg. Abnormalities-TOF (proximal atresia with distal fistula). TOF was repaired by ligation of the fistula and single layer interrupted nylon anastomosis of the proximal pouch and distal oesophagus on day one via a right thoracotomy at which a right sided aorta was recognised. Cardiac catheterization in the post-operative period showed right sided aortic arch with residual left aortic arch giving rise to the left subclavian artery, coarctation of right aortic arch with narrowing of anomalous right subclavian artery arising at the level of T4 from the right aortic arch.

The child's IVP showed normal renal tracts and bladder. Vomiting in the first few weeks post-operatively was due to partial thoracic stomach demonstrated by barium swallow.

The child is presently alive and well; and has had no cardiac surgery to date.

Case 2

Born at 34 weeks' gestation, weight 2.04 kg. Abnormalities-TOF (proximal atresia with distal fistula). The TOF was repaired as in case 1 via right thoracotomy on day one. At operation a right sided aortic arch with anomalous right subclavian artery arising at the level of T4 was recognised. Location of the tracheal fistula and distal oesophagus was difficult and required full mobilisation of the thoracic aorta which was retracted on tapes. Despite care not to do so aortic retraction resulted in poor distal flow snd subsequent acute renal tubular necrosis. In addition, the femoral pulses were (persistently) weak post-operatively having been pronounced pre-operatively. Following this episode the child did not recover. At post mortem a right sided aorta with anomalous right subcalvian artery and patent ductus arteriosus were confirmed. The descending aorta showed intimal damage.

Case 3

Born at 40 weeks' weight 2.26 kg. Abnormalities-TOF (proximal atresia with distal fistula) The TOF was repaired as in case one via right thoracotomy on day one at which a right sided aortic arch was noted. Anastomosis was not possible as the upper pouch was very high and the lower oesophagus was displaced by the right aorta. The oesophageal components were approximated with a view to reconstruction at a later date.

Cardiac catheterization in the post-operative period showed right sided aortic arch with ventricular septal defect and overriding aorta. Pulmonary valve atresia, atresia of the pulmonary artery with hypoplasia of the right and left branches of the pulmonary artery was also noted along with patent ductus arteriosus and persistent left superior vena cava.

The child acquired fatal septicaemia at four weeks.

COMMENTS

The incidence of cardiac anomalies associated with TOF is approximately 20-25 per cent half of which are minor abnormalities which do not interfere with the child's prognosis,[1] such a right sided aortic arch, anomalous right subclavian artery and persistent left superior vena cava. A further breakdown demonstrates that

cardiac anomalies are three times more common in cases with additional non-cardiac malformations[2] when compared with isolated TOF and twenty-five times more common than the incidence of anomalous cardiac development in the general population.[2] The incidence of right sided aorta in association with oesophageal atresia is approximately 4 per cent[1-3] as opposed to 0.1 per cent in the population at large.[4] There is a similar incidence of anomalous right subclavian artery and persistent left superior vena cava with TOF,[1, 3] and these lesions along with right sided aorta are mostly of interest to the surgeon during dissection of the chest, as mobilization of the TOF and the lower oesophagus in particular, is much more difficult, as the right sided aorta occupies the position normally taken up by that structure and displaces it towards the midline and left chest. Anastomosis of the upper and lower pouch is thus more difficult and if an anomalous right subclavian artery is also present not only does the upper pouch tend to be shorter than normal, but the course of the newly formed oesophagus will be longer to circumvent these vessels.

For the child the association of right sided aorta with Fallot's tetralogy (14-34 per cent) and truncus arteriosus (12-36 per cent)[4] is more significant than the oesophageal pathology as in all major series the life expectancy is reduced by 50 per cent when major cardiac anomalies are present.[1-4]

Also co-existing third and fourth pouch anomalies may be present. Of particular interest are thymic and parathyroid anomalies which may be as profound as complete aplasia.[5] None of the cases reported here demonstrated any abnormality in calcium metabolism and thymic function was investigated only in one case, with no apparent abnormality.

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TARSAL TUNNEL SYNDROME DUE TO A GANGLION: A Case Report

by

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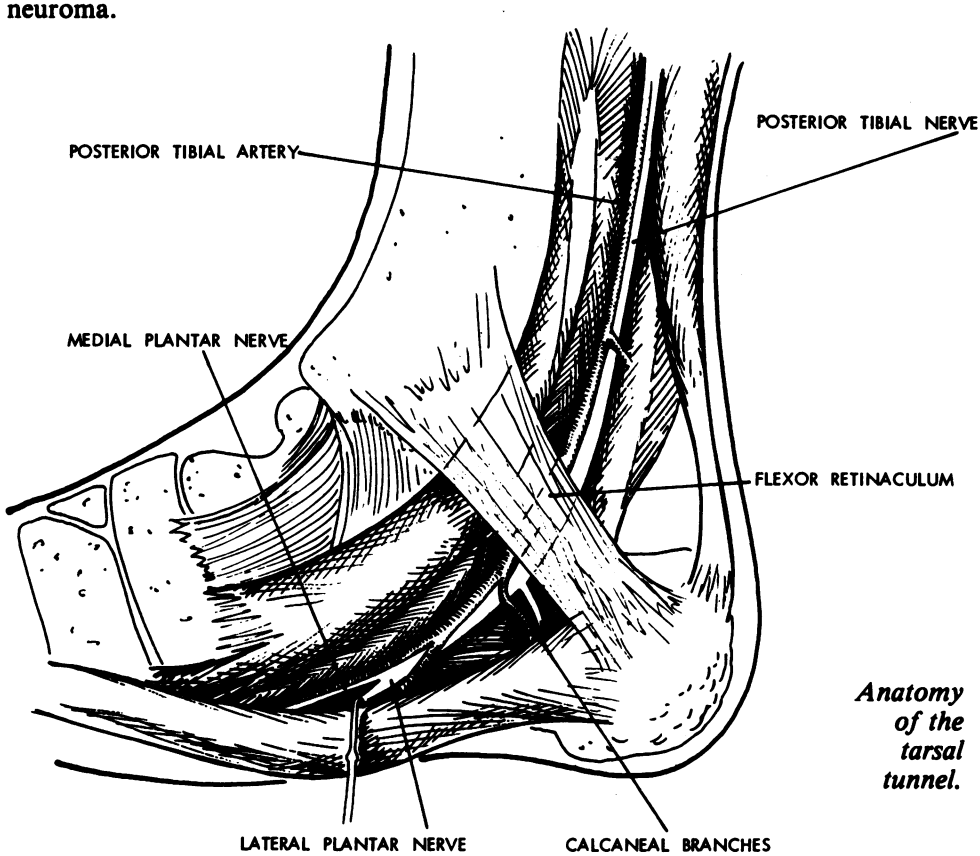
TARSAL tunnel syndrome is the pedal equivalent of carpal tunnel syndrome. The common aetiology of a tunnel syndrome is the compression of a nerve as it passes through an inextensible compartment. The nerve involved is the posterior tribial as it passes deep to the flexor rectinaculum, postero-inferior to the medial malleolus. The nerve divides to form the medial plantar, lateral plantar and calcaneal branches which together supply the small muscles of the sole of the foot and cutaneous sensation over the toes (Figure). Patients present with pain or paraesthesia over the distribution of one or more of the branches of the posterior tribial nerve. Diagnosis may be confirmed by nerve conduction studies in which prolonged conduction latencies can be demonstrated. It is a rare condition, often missed clinically or mistaken for other more common conditions e.g., plantar fasciitis or interdigital neuroma.



Anatomy of the tarsal tunnel.

CASE REPORT

A fifteen year old girl presented with a two week history of tingling over the heel and lateral aspect of the sole of the foot corresponding to the distribution of the lateral plantar and calcaneal branches of the posterior tibial nerve. At the same time she had noticed a swelling below and behind the right medial malleolus.

Examination revealed paraesthesia over the cutaneous distribution of the lateral plantar and calcaneal nerves, but the medial plantar nerve was uninvolved. A small round cystic swelling, approximately 2 cms in diameter, was palpable postero-inferior to the medial malleolus. It was fixed deeply but not to the skin. A diagnosis of tarsal tunnel syndrome due to ganglion was made.

Treatment was by surgical decompression. An incision was made over the swelling and the flexor retinaculum divided. The tibial nerve was obviously stretched across a large ganglion arising from the synovial sheath around the tendon of flexor digitorum longus. The ganglion was excised and the nerve was seen to be free from tension. The flexor retinaculum was not included in the closure.

There was some relief of symptoms immediately after operation, with full recovery of sensation within five weeks.

COMMENT

Tarsal tunnel syndrome has been sporadically reported throughout the literature and its aetiology is diverse. The most commonly reported aetiological factors in the literature are trauma, post-traumatic fibrosis, deformity of the foot, local venous distension, tenosynovitis, rheumatoid arthritis, and a variety of anomalies of the muscles and tendons which pass through the tarsal tunnel. However, about 25 per cent of cases are idiopathic.[1]

Tarsal tunnel syndrome secondary to space occupying lesions is quite rare, and a review of the literature has revealed only five previous cases where a ganglion in the tarsal tunnel has been the aetiological agent.[1-5]

Conservative treatment may be attempted initially by elimination or correction of the cause e.g., elastic stockings for venous engorgement, corrective footwear for deformity of the feet and local steroid injections for tenosynovitis. However, conservative measures are generally unsuccessful and surgical intervention is usually undertaken with good results.

All reported cases to date of tarsal tunnel due to a ganglion[1-5] including the one reported by the author have responded successfully to surgical decompression.

SUMMARY

A case is presented of tarsal tunnel syndrome due to compression of the posterior tibial nerve by a ganglion as it passes deep to the flexor retinaculum of the foot. This was successfully treated by decompression and excision of the ganglion.

I would like to acknowledge Mr. J. R. Nixon, FRCS and Mr. J. W. Calderwood, FRCS for their help with this case.

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SELENIUM DEFICIENCY DURING TOTAL PARENTERAL NUTRITION — A CASE REPORT

by

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THE trace element selenium has recently been recognised as an essential constituent of the enzyme glutathione peroxidase (GSHPx, EC 1.11.1.9) which is thought to have a major function in the removal of hydrogen peroxide and other organic hydroperoxides generated during oxidative metabolism.[1] Both selenium and vitamin E appear to protect against a myopathic condition seen in young animals put to pasture in spring after being fed indoors during the winter; this condition has been observed in England, Scotland and Northern Ireland.[2] Keshan disease is a fatal cardiomyopathy seen in children who live in a region in China where selenium levels are low in staple foods.[3] There have been few reports of selenium deficiency during long-term total parenteral nutrition.[4, 5] Currently available intravenous nutritional solutions contain negligible amounts of selenium.[5]

CASE REPORT

A 39-year-old male with long standing ankylosing spondylitis underwent manipulative spinal osteotomy to correct spinal deformity. Four days later he became profoundly shocked, with respiratory and renal failure. Initial laparotomy revealed a large perforated gastric ulcer. A long complicated illness ensued, with prolonged respiratory failure necessitating artificial ventilation via a tracheostomy, dopamine infusion and haemodialysis. A further laparotomy was performed to drain a subphrenic abscess and a gangrenous gallbladder was removed.

Frequent bouts of septicaemia were treated with a multitude of antibiotics. Fifteen weeks after the start of his illness, blood cultures were positive for *Candida albicans*. A course of anti-fungal drugs was instituted (miconazole and 5-fluorocytosine, with the addition of amikacin).

Two weeks later, a third laparotomy was performed because of persistent vomiting. There was jejunal obstruction due to adhesions which were divided, and a feeding duodenostomy was fashioned. During the operation the stump of the cystic duct was opened, and culture of the bile which escaped grew *Candida albicans*. A few days later he suffered an asystolic cardiac arrest from which he was resuscitated. His condition remained critical, requiring continuous dopamine infusion, and there were persistent clinical signs of septicaemia. There was a protracted metabolic acidosis and marked muscle hypotonia. He had now been maintained on conventional parenteral nutrition supplemented with vitamins (including tocopherol), trace elements and thrice weekly fat emulsion infusion, for 19 weeks. Serum Fe, Zn, Mg, Cu, B12, foliate, vitamin E and ferritin were all within normal limits. Amphoteracin B was added to his anti-microbial therapy, and a preparation of selenium yeast as sold to vegans (200 ug/day) administered via the duodenal tube. Four days later his condition was so improved that he wished to sit out of bed. After two weeks, a preparation of selenomethionine became available

and was administered intravenously (100 ug/day) for 17 days until it was possible to discontinue all intravenous lines. The patient was discharged to spend Christmas at home after a record 178 days in the Intensive Care Unit.

DISCUSSION

The normal dietary intake of selenium in man is about 60 ug daily, and there is a wide range.[6] Incapacitating muscular pain in one patient receiving long-term parenteral nutrition disappeared after selenomethione was added to the intravenous solution.[5] Table I shows the plasma levels of selenium and the red blood cell concentration of GSHPx during and after therapy, and the currently accepted normal values. Unfortunately, blood taken prior to the start of therapy was unsatisfactory for analysis of plasma selenium. Erythrocyte GSHPx level before treatment was approximately half the lower limit of normal, but our patient had had a recent blood transfusion, and it is known that this can confuse the usefulness of erythrocyte GSHPx activity as an indicator of selenium status by trensfer of the enzyme via the donor blood.

TABLE 1

Plasma selenium and erythrocyte GSHPx levels before, during, and after therapy. The last column indicates the normal range.

Time of sample	*Before treatment*	*After 2 weeks enteral (200ug/day)*	*After 17 days parenteral (100ug/day)*	*Four weeks after discharge*	*Normal range*
Plasma Se ug/l	—	39	52	87	80-120
Erythrocyte GSHPx iu/g Hb	26	17	23	45	30-60

The efficiency of absorption of selenium from the gut, the bio-availability of oral preparations, and the effect of sepsis on requirements are all unknown. The amount of selenium required for supplementation is as yet empirical. The plasma level of selenium 10 days after cessation of therapy was still below the lower limit of accepted normal in our patient, but since the total body content of the element is about 6000 ug[5] in normal man, gross cellular deficiency may have led to considerable shift of the element from plasma to cell.

Selenium is an essential trace element for normal cellular function, and GSHPx protects lipid membranes from oxidative damage and with tocopherol (vitamin E), helps remove free radicles, superoxide and singlet oxygen.

Animal studies[7] indicate that neutrophils from selenium and vitamin E deficient steers were unable to kill ingested *Candida albicans* cells and there is evidence to suggest that there is a decreased immunoglobulin response in vitamin E and selenium deficient animals.[8] Although our patient had normal vitamin E levels

following intravenous vitamin supplementation, selenium deficiency may have led to immunosuppression in spite of prolonged antibiotic therapy, and may also have been the reason for the severe and persistent metabolic acidosis.

The possibility of selenium deficiency should be considered in any patient receiving total parenteral nutrition for more than four weeks.[5]

ACKNOWLEDGEMENT

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SEVERE MENTAL RETARDATION DUE TO MATERNAL PHENYLKETONURIA

by

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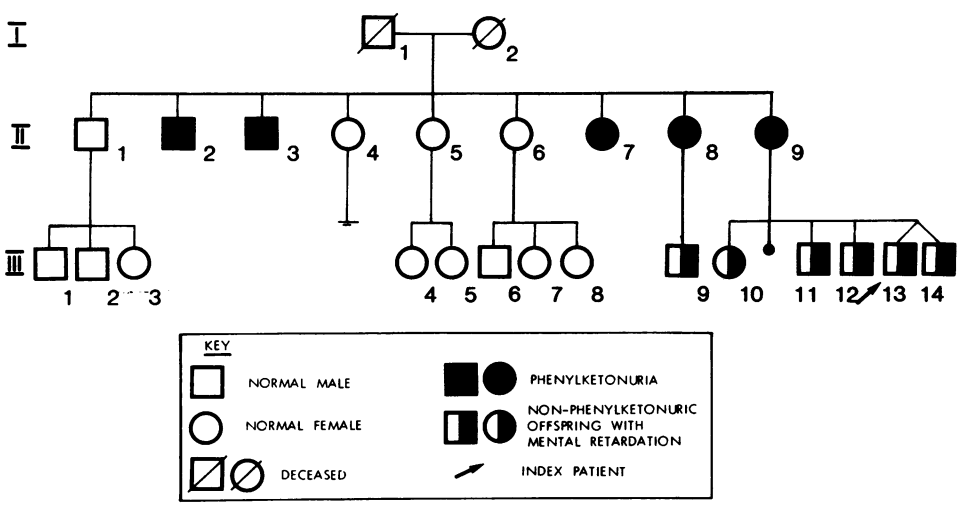
PHENYLKETONURIA (PKU) which, in Northern Ireland, has an incidence of one in 4362 newborns,[1] is a metabolic disorder in which the conversion of phenylalanine to tyrosine is impaired due to the reduction in activity of the enzyme phenylalanine hydroxylase. It is inherited an an autosomal recessive trait. If begun in early infancy, a low phenylalanine diet which controls the biochemical abnormalities prevents severe mental retardation. However, since 1957[2] it has been recognised that infants born to women with PKU have a high risk of mental retardation, microcephaly, congenital heart disease, and low birth weight. We report a family in which two sisters, both with unrecognised PKU had a total of six children, all of whom had microphaly with mental retardation.

CASE HISTORY

The index patient (Figure III,13), a two-month-old infant was referred to the Department of Medical Genetics for investigation of microcephaly. His dizygotic male co-twin (Figure III,14) was similarly affected. Investigation of the family revealed that an older sister and two older brothers (Figure III, 10-12) were also mentally retarded with microcephaly. Extensive cytogenetic, radiographic, and virological studies of these children gave negative results.



Pedigree of family

The mother (Figure II,9), born in 1947, was found to have a plasma phenylalanine value of 1520 umol/1, as in classical PKU. She commenced school at 6 years old and left at 15 years of age without ever passing any examinations. She married at the age of 19 years. For a few years after leaving school, she worked as a clipper in a shirt factory. She is the youngest in a sibship of nine. Of three older brothers, two (Figure II,2 & 3) were severely mentally retarded with plasma phenylalanine values of 1698 and 1800 umol/l, and had unrecognised classical PKU. Of her five sisters, one (Figure II,7) also had unrecognised classical PKU with severe mental retardation and a plasma phenylalanine value of 1557 umol/1. Another sister (Figure II,8) was an unrecognised PKU with a phenylalanine level of 1479 umol/1. This sister had one child (Figure III,9), a male, who was severely mentally retarded with microcephaly.

DISCUSSION

This family illustrates the tragic fact that women with PKU have an extremely high risk of having children with mental retardation, microcephaly, and congenital abnormalities. Since the first recognition of the maternal PKU problem,[2] many reviews on this subject have been published.[3, 4, 5, 6, 7, 8] In all, a total of 524 pregnancies in 155 mothers with PKU or some degree of hyperphenylalaninaemia have been documented. The non-PKU offspring of women with PKU have mental retardation, microcephaly, congenital heart disease, and low birth weight. Women with PKU also have an increased frequency of spontaneous abortion.

The mechanisms by which the mental retardation and the congenital abnormalities result from maternal PKU is uncertain. Abnormalities of cerebral lipids in a non-PKU offspring of a PKU woman were similar to those observed in patients with PKU, suggesting that the fetal brain damage was related to prenatal exposure to high levels of phenylalanine and/or phenylalanine metabolites in the mother. Alternatively, in the rat, a reduced fetal tissue concentration of L-tryptophane, impaired uptake of L-tyrosine and L-tryptophane and reduced brain pyruvate kinase activity has been found in fetuses of hyperphenylalaninaemic dams.[10] The prenatal brain damage thus could be due to decreased protein synthesis due to the unavailability of tryptophane.

Treatment with a low-phenylalanine diet has been given during 30 pregnancies.[11] It appears that treatment begun in the first trimester results in better intellectual development in the offspring than when treatment is begun later in pregnancy. However, there was no clearly beneficial effect in preventing microcephaly or congenital heart disease. Even good biochemical control, as reflected by periodic maternal blood phenylalanine levels, is no guarantee of a normal outcome. One woman, despite the introduction of a low phenylalanine diet five weeks after conception[12] gave birth to an infant with microcephaly and severe cardiac abnormalities. Beginning treatment prior to conception might be a reasonable approach. The offspring from two pregnancies in which treatment was started prior to conception resulted in normal offspring.[13, 14] However, with such a small number of cases treated preconceptionally no firm conclusion can be made as to the effectiveness of such treatment. The identification of women with PKU is important. The M.R.C. and D.H.S.S. now have a national register of fertile women with PKU. All known PKU females enter this register at the age of 14 years. Women with PKU who want children should plan their pregnancies to allow initiation of treatment before conception.

SUMMARY

A family is described in which two women with unrecognised phenylketonuria had a total of six pregnancies of which one was a spontaneous abortion and five resulted in six children with severe mental retardation and microcephaly. The possibility of dietary management during pregnancy in preventing severe mental retardation in their offspring is reviewed.

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GENERAL PRACTITIONER REFERRAL LETTERS— THE CONCEPT OF A FIXED-HEADING FORMAT

by

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DAISY Hill is a district general hospital with approximately three hundred beds providing acute medical, surgical and maternity facilities for the market town of Newry (Co. Down) and its mainly rural hinterland. The district has a population of some 76,000 (1980) with 26,000 concentrated in the town of Newry itself. This population is served by thirty-six general practitioners, with an average list size of approximately 2,100 patients.

The acute medical and geriatric unit consists of sixty-six beds, and admission to the unit is by one of the following routes:

1. Referral from a general practitioner as a direct admission to the ward.
2. Via the out-patient department.
3. Via the accident and emergency department.
4. Following a domiciliary visit by one of the consultant physicians.

The majority of admissions are via the first route, i.e. directly from the general practitioner. We had noted that patients admitted in this manner did not always have a referral letter accompanying them. Many were found to be on drug therapy at home which was difficult to elicit in some cases if there was no accompanying letter or if the details were omitted on the letter. Our aim was to evaluate general practitioner referral procedure in respect of direct admission to the ward with regard to the following points:

1. The presence or absence of a referral letter.
2. Whether or not the patient was on drug therapy at home.
3. Did the letter (if present) state the name and dose of the drugs.

METHODS

The Study Population—The total number of consecutive general practitioner referrals for direct admission to the unit over a three month period (July—Sept. 1981) were assessed. This group amounted to 108 patients.

Data Collection—A questionnaire was drafted to answer the points raised in the introduction. This was inserted into the chart of each patient in the study group and was completed by the admitting officer, The completed forms were then collected for analysis at regular intervals.

RESULTS

These are displayed in Figure 1. The numbers refer to the actual number of patients in each category. The total number of patients evaluated was 108 and 84 patients who were on drug therapy at home prior to admission.

FIGURE 1

Results of Referral Letter Evaluation

(a)	Referral Letter	Present—82 (76%)	Absent—26 (24%)
(b)	Patients on Drug Therapy prior to admission	On Drugs—84 (78%)	Not on Drugs—24 (22%)
(c)	Presence or absence of Referral Letter in those Patients on Drugs prior to admission	Absent—21 (24%)	Present—63 (76%)
(d)	Name of Drugs stated on the Letter	Stated—33 (52%)	Not Stated—30 (48%)
(e)	Dose of Drugs stated on the Letter	Stated—21 (22%)	Not Stated—42 (68%)

(a) and (b) relate to the total number of patients evaluated.
(c), (d) and (e) refer to those on drug therapy at home prior to admission.

DISCUSSION

This short study revealed that a large proportion (24 per cent) of patients, arriving at hospital for direct admission, do so without a letter of referral from their general practitioner (Figure 1a). It also showed that a large number of patients had been on medication of some kind prior to admission (78 per cent, Figure 1b). Just over one half of these patients had the details of the medication documented by their general practitioner on a referral letter (Figure 1d). Approximately one quarter of *these* patients did not have a letter with them at all (Figure 1c).

The category of the referring practitioner, i.e. locum, deputy etc., was not analysed and data relating to season or day of week or time of day could not be included in a study of only three months duration. Given the number of patients in our study and the relatively small size of the district it is not possible to draw statistically significant conclusions on the basis of these figures. But the results of more extensive studies performed elsewhere in 1969[1] and 1978,[2] (Table I) indicate a much higher incidence of absent letters in the present study. They also show a comparable absence of information about medication details. Standards are certainly not improving.

The benefit of having a good quality referral letter has been analysed. The letter provides the link between the family practitioner and the hospital doctor, especially when the latter is seeing the patient for the first time.[3] It can provide valuable information which is significant not only in medical terms, but also in social and administrative terms.[4] Telephone conversations between general practitioners and hospital doctors regarding patients for admission are not a proper substitute for well

TABLE 1

Comparison of present study with others published

	Newry (1981)	Cork (1978)	Amersham (1969)
Admitted without a Referral Letter	24.0%	10.9%	11.7%
Medication details absent	48.0%	49.1%	50.0%

documented referral letters. For those patients receiving medication it is likely that the majority of their drugs have been renewed, if not actually initiated, by their general practitioner. Therefore, he should be in a good position to know and document exactly the number of drugs and dosage. This is doubly important, firstly because patients often have great difficulty in remembering the names of their drugs (although they seem to recount the dose accurately) and secondly, in the drowsy, confused, unconscious or elderly patient, the history is often neither accurate nor obtainable.

Failure to give the drug therapy details has been criticised in the past.[5] Drug history is extremely important as the number and range of drugs currently available is so high. With such a large proportion of patients on drugs, often several drugs, prior to admission, the incidence of drug related disease is of sufficient frequency to warrant accurate documentation on a referral letter. There is also, of course, the possibility of drug interaction leading to significant related morbidity.

All patients being referred to hospital for admission should have a referral letter from their general practitioner. This letter should attempt to document all relevant information about the patient with particular reference to the drug history. Why is the standard of referral letter less than it should be? The present form, MR.48., which is widely used as a referral letter is basically a blank sheet.

Studies (1-5) of general practice referral letters have assessed their value and some have offered suggestions as to how their effectiveness might be improved such as the supply of more comprehensive information and better legibility in writing. Others[1] have suggested that the general practitioner should follow a 'Format' when documenting the information. We have taken this approach a stage further in the concept of a standardised referral letter which in terms of potential for improved documentation has remained relatively unexplored. This particular 'standard letter' (Figure 2) has the advantage of fixed headings which are already printed on the sheet and as such will enable the general practitioner to respond under each section and therefore help improve both the clarity and value of the information given.

The use of fixed headings to supply 'cues' and thus prompt responses with regards to medical records has already been shown in a hospital study to promote greater accuracy in clinical acumen and thereby increase efficiency.[6] Therefore the overall concept of structured note-taking is by no means a new one especially with regard to the collection of data for computer analysis[7] and the increasing implementation of medical audit. The general practitioner referral letter can benefit from these advances.

FIGURE 2

Format of the pre-printed "Fixed-Heading Referral Letter"

Date .....

Patient's Name ..... **Age** .....

Address..... **Previous Hospital Number**

....

.....

Occupation .....

History .....

.....

.....

.....

.....

Examination

Previous Medical History ..... **Allergies** .....

....

....

.....

Signed .....

Drug Therapy ..... **STAMP**

.....

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Provisional Diagnosis .....
and Comment .....

.....

Some hospitals, all area boards and in particular the Central Services Agency have expressed interest in a 'standard letter'. We believe, on the evidence of this study, that the time has come to promote such a letter format for the advantage of doctor and patient.

SUMMARY

We undertook a short study to evaluate the general practitioner referral letters in our district as a prelude to the introduction of the concept of 'Fixed-heading referral letters' for use on a regional basis.

Almost a quarter (24 per cent) of patients being referred for admission to hospital by their general practitioner did not have a referral letter accompanying them. In those patients who had an accompanying letter, information about medication (name, dose, etc.) was unrecorded in over half of the cases.

A standardised format for the referral letter would improve compliance and greatly increase its value. This standard format employing fixed-headings and pre-printed on suitable sized notepaper could be instigated at regional level for circulation to general practitioners.

ACKNOWLEDGEMENTS

We wish to thank Dr. J. E. Devlin, Dr. E. G. McQuillan, the medical and nursing staff of the medical unit of Daisy Hill Hospital and Dr. P. M. Reilly of the Department of General Practice, Queen's University, Belfast, for their help in the preparation of this paper.

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INDUCTION OF LABOUR USING PROSTAGLANDIN PESSARIES OF VARYING STRENGTH

by

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INTRODUCTION

AN ideal method of induction of labour should be simple, safe, effective and non-invasive thereby increasing the acceptance by the patient and reducing the risks associated with amniotomy. The unripe cervix has always been a problem but in recent years prostaglandin E_2 has been shown to have a direct effect on this, possibly by modifying the glyco-amnio glycans in the cervical ground substance.

Over the past few years prostaglandin has been used with varying success rates by differing routes, however its use intravenously and orally has been limited by the side-effects of gastro-intestinal disturbance and local cellulitis at the venopuncture site. Prostaglandin has been administered as a jel extra-amniotically and as a pessary with encouraging results reported in the recent medical literature. Work from Queen Charlotte's Hospital by Shepherd et al. suggests that induction of labour using a 3 mg pessary can be a highly efficient and acceptable procedure. However, it was noted by these authors that a multiparous patient with a favourable cervix had vigorous uterine contractions upon insertion of the pessary. Uterine hypertonus had been noted by us in a higher percentage of cases while using a 3 mg pessary even when the cervix was not particularly favourable. Gordon-Wright and Elder have demonstrated that there is rapid systemic absorption of prostaglandin after administration of the drug in pessary form with a maximum effect in two hours and that the systemic level can remain high for up to six hours—this may explain the cases of hypertonus.

In 1980 Liggins had shown that small amounts of prostaglandins vaginally are also successful in inducing labour—the dose he used was 1/15th of the Queen Charlotte dose—0.2 mg without the risk of hypertonus. This paper presents the results of a study carried out at the Jubilee Maternity Hospital, Belfast comparing 3 mg pessaries on two occasions with lower dose pessaries (2.0 mg and 0.5 mg) administered more frequently in an effort to rationalise the use of this drug and minimise the potential hazard of hypertonic uterine action.

PATIENTS AND METHODS

From the 1st May 1980 all patients at the Jubilee Maternity Hospital requiring induction had prostaglandin pessaries with the exception of four categories:-

(1) Patient or consultant objection
(2) The cervix greater than 3 cms dilated
(3) Patients thought to be at risk of developing fetal distress in labour
(4) The presence of intrauterine death.

Pessaries:

As prostaglandin has a short half life the pessaries were made up in our local pharmacy using a glyceride base (Witepsol)—these have a ward refrigerator life of 5 days. In all, 300 patients were included in the trial and 70 per cent of the inductions were carried out for hypertensive states or post-maturity. The others were carried out for various other medical and obstetrical indications.

The 300 patients were randomly allocated into one of three groups of 100. As seen in Table I the weaker pessaries were inserted more frequently and if labour had not intervened in the stipulated time (24 hours Group A; 48 hours Groups B & C) induction of labour was carried out using amniotomy and syntocinon infusion.

TABLE I

Pessary dose and time of administration

GROUP	A (n = 100)	B (n = 100)	C (n = 100)
PESSARY STRENGTH	3 mg	2 mg	0.5 mg
TIMES	09.00 17.00	09.00 13.00 17.00	09.00 12.00 15.00 18.00 21.00
MAX. NO.	2	6	10

Prior to the insertion of the first pessary the favourability for induction was assessed by means of a modified Bishop score. This takes into account four features regarding the cervix, namely dilatation, length, consistency and position which with the station of the head one can allocate a maximum score of 12 points. A score above 8 is regarded as "favourable" and less than 5 "unfavourable".

After insertion of a pessary the patient remained supine for one hour and thereafter was able to be up and about the antenatal ward. Transfer to the labour ward occurred when the cervix was 4 cms dilated and some patients had augmentation with Syntocinon at the discretion of the Labour Ward Staff. Internal monitoring of labour was used in all but eight of the cases.

RESULTS

There was no significant difference in the three groups with regard to maternal age, weight, height or parity. The gestational age was found to be comparable in all three groups—just over term.

The mean Bishop scores were 5.8, 5.7 and 5.5 respectively. When the outcome of each group was analysed the induction delivery intervals were 15.5 hours, 14.7 hours and 29.5 hours respectively—the 0.5 mg pessaries taking significantly longer ($P > 0.001$). There were significantly fewer patients in Group B (5) who failed to go into established labour after the stipulated time compared with Group A (17) and Group C (24). Of those who went into spontaneous labour with the pessaries

47 per cent in Group A, 38 per cent in Group B and 53 per cent in Group C required augmentation with Syntocinon infusion during labour.

Table II demonstrated the average amounts of prostaglandin used in each group. Significantly less prostaglandin was used in Group C. However, as mentioned above the induction-delivery interval was greatly increased and 24 per cent failed to become established in labour after 48 hours.

TABLE II

Average amounts of prostaglandin required to induce labour

	A (3 mg)	B (2 mg)	C (0.5 mg)
Average number of pessaries	1.6	2.0	5.6
Average PGE_2 (mg)	4.8	4.0	2.5

TABLE III

Mode of Delivery

	A (3 mg)	B (2 mg)	C (0.5 mg)
Normal	81	82	78
Breech	1	—	—
Assisted delivery	9	12	11
Caesarean section	9	6	11
TOTAL	100	100	100

There was no significant difference in the incidence of occipito-posterior position in labour or in the assisted delivery rate. Fewer Caesarean sections were performed in Group B. The number of assisted and operative deliveries carried out for fetal distress was similar in each group (Group A nine; Group B six; Group C eight).

BABIES

Apgar scores were similar in each group with four babies with an initial Apgar score less than 6—three in Group A and one in Group C.

Group A:—Fetal distress: forceps delivery
—Fetal distress: Caesarean section (hypertonus)
—Breech presentation
Group C:—Dysmature fetus

All babies subsequently progressed satisfactorily and there were no perinatal deaths in this selected group of patients.

PATIENT ACCEPTABILITY

In general, the patients were enthusiastic about this method of induction using terms like "more natural" to describe the experience and all multiparae who had labour induced before by amniotomy and syntocinon preferred this method.

Six patients of the 0.5 mg group complained of stinging in the vagina. This has been shown in other centres to be associated with monilial vaginitis, however we had no data to prove this in our series.

Vigorous labour was noted by eight patients in the 3 mg group and two of these cases had definite hypertonus. The first was a para one aged 33 years with a modified Bishop score of two in whom induction was being carried out for prolonged pregnancy. Two hours after insertion of a 3 mg pesary persistent bradycardia in association with a tonic uterine contraction was noted. Preparations were made for delivery by Caesarean section and 20 minutes later, just before operation, it was noted that the cervical dilatation was unchanged and that the tonic uterine contraction persisted. At Caesarean section a male fetus was born weighing 2840 g with an Apgar score of four at one minute and ten at five minutes. The second patient was a para one aged 34 years whose initial Bishop score was four and in whom the second 3 mg prostaglandin pessary was inserted because the cervical dilatation was unchanged. Over the next hour very strong uterine contractions developed and continued until the patient was delivered one and a half hours later. The baby weighed 3280 g and had an Apgar score of five at one minute and nine at five minutes.

DISCUSSION

Vaginal administration of prostaglandin E_2 pessaries has been shown to improve the outcome of induced labour in other centres where it has been used effectively for routine induction of labour. However, the potential advantages which have been put forward enthusiastically have to be balanced by the problems associated with the instability of the preparations used and the variable and sometimes very rapid absorption of prostaglandin. This study was undertaken to determine whether repeated low doses of prostaglandin might be as effective as a higher dose in inducing labour, thereby reducing the risk of unduly rapid progress in labour.

The results suggest that the lowest dose pessary (0.5 mg) given in the manner described is not as effective as one six times this strength (3 mg). Although the low dose pessary was successful in inducing labour in 73 per cent of women in this series (similar to that reported by Liggins), the number of induction failures after 48 hours with this pessary was much higher than when the high dose was used. Also, the overall induction-delivery interval was significantly longer and a small number of patients required excessive analgesia. Because of these factors, the lowest dose pessary cannot be recommended. While the 3 mg pessary is very effective in inducing labour we cannot endorse its use because of the unpredictable risk of vigorous labour and hypertonus encountered in our patients with the consequent risks to both mother and fetus.

The compromise seems to lie with the 2 mg pessary administered four hourly—where one finds the lowest mean induction-delivery interval of 14.7 hours with a significantly lower Caesarean section rate of 6 per cent in the absence of hypertonic uterine action. The mean number of pessaries used in this group is also very low at two. From the practical point of view we now use 2.0 mg pessaries in the manner described routinely in all patients requiring induction of labour where the cervix is less than 3 cms dilated.

While the pessaries are expensive (£5 each) and have a short shelf life, the advantages in our experience seem to outweigh the disadvantages. This easily-

administered, non-invasive method of induction, which ensures the integrity of the membranes, in this dose is relatively free from side-effects and is very acceptable by both staff and patient alike.

It is more physiological in its action and we have halved the Caesarean section rate in induced primigravidas since the method was introduced, bringing the overall hospital rate to under 10 per cent. The problems of inducing labour where the cervix is unfavourable have been greatly reduced at no apparent risk to mother or fetus. We do accept that the use of this drug must be carefully monitored, and we are keeping the matter under constant review.

SUMMARY

Prostaglandin E_2 has been used by varying routes over the past decade to induce labour. Recently, vaginal pessaries have been used as a convenient non-invasive method of inducing labour. However, the risk of uterine hypertonus is still encountered.

A randomised trial is described which aims to ascertain the most effective pessary strength and regimen, while reducing undesirable side effects to a minimum. Our experience suggests that 2 mg pessaries four hourly is the most safe and effective method.

ACKNOWLEDGEMENTS

We thank the Consultant Staff of the Jubilee Maternity Hospital for permission to study their patients, for the co-operation of the Nursing Staff and the Pharmacy Staff who prepared the pessaries.

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EXPERIENCE WITH THE ZICKEL DEVICE

by

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INTRODUCTION

SUBTROCHANTERIC fractures of the femur are difficult to treat successfully. Fractures in this region show typical displacement. The strong gluteal muscles abduct the proximal fragment, whereas the adductors inserted below the fracture site adduct the distal fragment—see Figure 1. Biomechanical analysis of stress in the femur shows a high concentration of stress in the subtrochanteric region. Also, these fractures occur in bone that is predominantly cortical. These two factors, i.e. cortical bone and stress, have been suggested as reasons for the high incidence of complications.[1] The incidence of mechanical complications, i.e. breakage or bending of the fixation devices, has been reported by Seinsheimer[1] to exceed twenty per cent. Skeletal metastasis in the subtrochanteric region are frequent and pose a problem for fixation. The high stresses plus loss of bone substance make pathological fractures more difficult to stabilise than non-pathological ones.

It is generally agreed that the best way to treat subtrochanteric fractures is by open reduction and internal fixation.[2] However conventional blade plate devices are often unsatisfactory especially in pathological fractures because of loss of fixation.[3] Heiple and colleagues[2] report a significant rate of failure of the fixation device using long blade plates.

The Zickel nail was designed specifically to fix securely both proximal and distal fragments of subtrochanteric fractures. Figure 2A and B shows views of Zickel device before and after assembly. Studies of the use of this device for subtrochanteric fractures, both traumatic and pathological, have been encouraging (Mickleson et al 1976: Zickel et al 1976).[3, 4]

The purpose of this paper is to describe our results using Zickel nail fixation for the treatment of seventeen patients who had either traumatic or pathological fractures in this region of femur.

MATERIAL

Seventeen patients were treated over a three year period for traumatic or pathological fractures of the subtrochanteric region. Seven of the patients were male and ten were female. The ages of the patients ranged from sixteen to ninety-five years. Of the seventeen fractures, twelve were traumatic and five were pathological. One of the men presented with multiple injuries as a result of trauma. Two of the patients had had a previous attempt at internal fixation using conventional blade plates.

It was decided to categorise the fractures using the classification suggested by Seinsheimer[1] as follows.

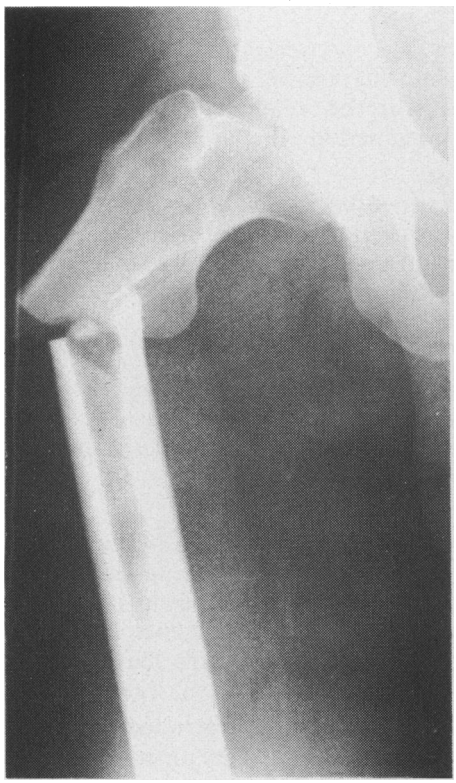

FIG. 1
This shows the typical deformity that follows a subtrochanteric fracture.

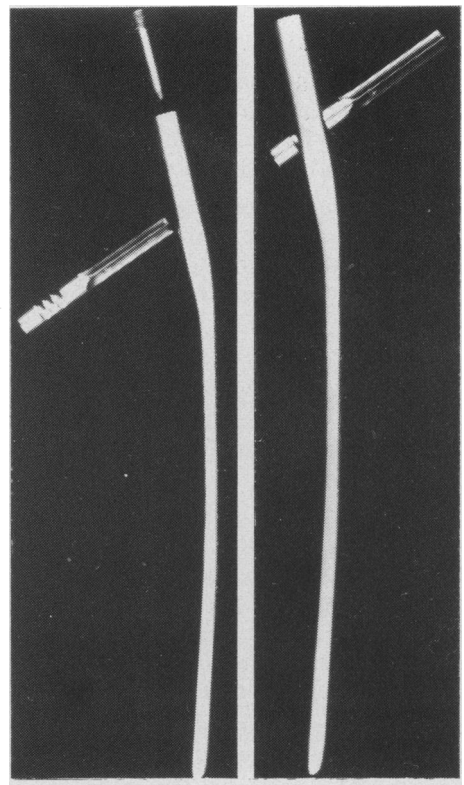

FIG. 2A and B
This shows an exploded and an assembled view of the Zickel nail. After inserting the nail into the medullary canal the pin is screwed up into the femoral neck.

Type I — Non-displaced fractures or any fractures with less than two millimetres displacement.
Type II — Two part fractures.
Type III — Three part fractures.
Type IV — Comminuted fractures with four or more fragments.
Type V — Subtrochanteric-intertrochanteric fractures, any subtrochanteric fracture with extension through the greater trochanter.

Using this classification we were able to divide our seventeen patients into the following groups:

Type	I	II	III	IV	V
Number	0	7	1	3	5

The remaining fracture involving the femoral neck could not be classified using this scheme.

RESULTS

Fourteen of the patients were operated on within one week of the fracture being recognised. The general condition of one patient who received multiple injuries was such that operation was delayed for three weeks. In the remaining two patients the delay was up to five months, but in the intervening period other attempts at internal fixation had been tried.

The operative technique used was that described by Zickel, except that all the patients were in the lateral position. The only problem encountered at operation was excessive anteversion or retroversion of the intramedullary rod. This had to be adjusted in order to allow correct placement of the neck pin.

POST-OPERATIVE COURSE

All the patients were able to sit out at twenty-four to forty-eight hours following operation. All were walking with aids within two to four days. There were no cases of wound infections. There were no deaths in the immediate post-operative period.

FOLLOW-UP

At the time of this study, three of the patients with pathological fractures had died. The remaining patients were ambulatory at review. Two of the patients had a routine removal of the fixation device one year following operation. Bony union was achieved in fifteen cases. Even the pathological cases showed evidence of union. Malunion developed in one case with a type V fracture. However she remained symptom free and quite mobile. Because of this no further treatment was required.

One Zickel nail required early removal when the pin protruded into the acetabulum causing pain. This occurred in our oldest patient, aged ninety-five, also with a type V fracture. However, following removal, the patient was symptom free and quite mobile with a Zimmer aid.

DISCUSSION

The Zickel nail has the advantage over other devices in that it is strong enough to stabilise weakened bone and, by the nature of its design, prevents rotation at the fracture site. Figure 3 shows a type IV fracture and how it was successfully managed using a Zickel nail.

The aims of treatment in our series were two-fold:-

1. Relief of pain by secure fixation.
2. Early ambulation.

Other means of internal fixation may be equally effective in producing pain relief, but these do not necessarily enable early ambulation. Early mobility is increasingly important with older patients in reducing the incidence of post-operative complications. An early return to normal in patients with pathological fractures secondary to a neoplasm is particularly beneficial. It has been shown by Parrish and Murray[5] that such patients have an average survival time of five months, and early ambulation would therefore increase the quality of their remaining life.

Zickel,[4] in a study of eighty-four cases, had only had one failure of fixation and in another series of thirty-five with pathological fractures, early ambulation was

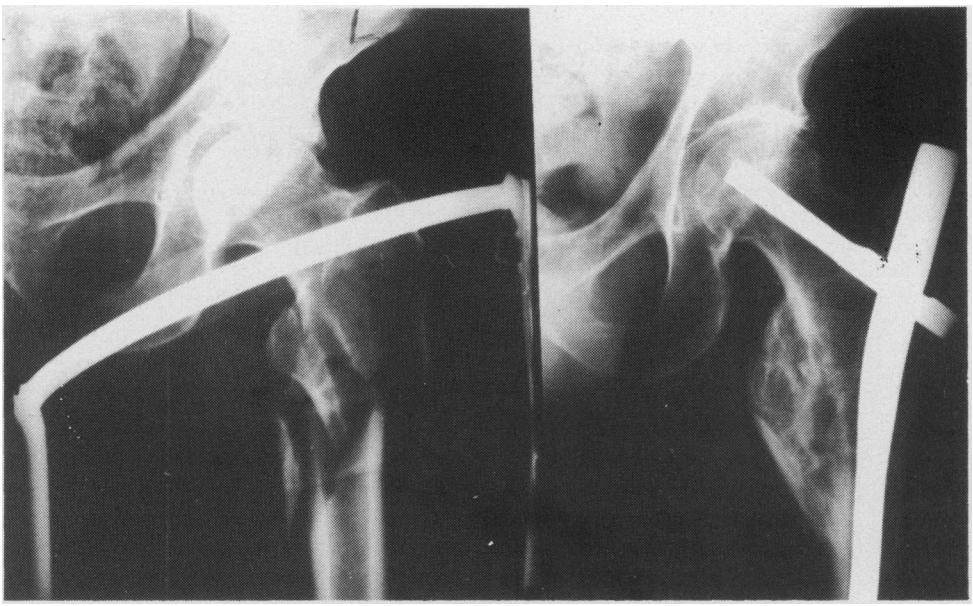

FIG. 3

This shows a comminuted subtrochanteric fracture (type iv) that was successfully stabilized using a Zickel nail.

achieved in nearly every case. In our own series, two of the patients had had previous unsuccessful attempts at fixation using blade plates. It was interesting that both cases, when treated with Zickel nails, proceeded to good bony union without any further problems.[4]

Failure of fixation with conventional devices is usually seen in the first six months.[1] In our series, which was reviewed between three months and three years from operation, only one nail required early removal.

Our group is small and no statistically significant conclusions can be drawn from the results. However, the trends of our findings were very similar to those of Zickel and Mouradian[4] and Mickelson and Bonfiglio.[3] If we then consider our results alongside theirs and then compare them with those of Seinsheimer[1] and those of Heiple and associates,[2] they tend to give some support for the use of Zickel nails.

In conclusion, we therefore feel that when treating patients with subtrochanteric fractures, and especially in those where early ambulation is desirable, internal fixation using a Zickel nail is a form of treatment well worth considering.

SUMMARY

Seventeen patients with subtrochanteric fractures of the femur were treated by internal fixation with a Zickel nail. Five of the patients had pathological fractures. Bony union was achieved in sixteen cases. Early mobilisation was achieved in all cases. There were no failure of the fixation device, although one patient developed mal union.

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BREAST DISEASE IN WOMEN UNDER THIRTY—TEN YEAR REVIEW AND ASSESSMENT OF CLINICAL SCREENING

by

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INTRODUCTION

SCREENING women for the detection of breast cancer by examination is well established although not yet fully assessed. Studies, like that of the HIP[1] in New York, have shown that screening, including mammography, has probably little value under the age of 50 and this is supported by other studies. Nevertheless, publicity has increasingly induced younger women to seek what they believe to be the benefits of clinical screening, and screening for breast lesions is carried out routinely in many family planning and well women clinics where young women predominate. Screening programmes developed by charitable and commercial organisations also extend screening facilities to all ages of women.

This study was undertaken to evaluate breast screening by examination in women under the age of 30 and to relate this to the incidence of breast biopsy in hospital practice.

METHODS

In the first study the records of all women who had been operated on in the Royal Victoria Hospital from 1970-1979 were assessed. Only women who had a formal excisional biopsy of the breast lump were included. Information was obtained on the annual numbers operated on, age at first presentation, the diagnosis and the time which elapsed between first noticing the lump and presentation.

In the second part of the study information was collected on women seen at screening clinics organised by 'Action Cancer' in Ulster. Patients were examined by a doctor in the main clinic or were seen in a mobile unit by a nurse who would refer some patients to the doctor at the centre. During the time under study most patients were seen by one particular doctor and one nurse. Mammography was not used in women under 40.

The results cover a period from September 1978 when the centre opened to the end of April 1980.

RESULTS

In the first study 297 patients qualified for inclusion in the study and of these 28 charts were unobtainable leaving 269 patients as the study population. In 1970 28 excisional biopsies were carried out and these fell to 16 in 1972 but since then have steadily risen until in 1979 44 were performed (Figure 1). The fall in 1972 was probably associated with difficulty of access to the Hospital during periods of civil disturbance.

The diagnosis was determined from the histological reports (Table 1). There were 106 patients (40 per cent) with the diagnosis of fibro-adenoma and their distribution throughout the 10 years does not show the same rising incidence (Figure 1).

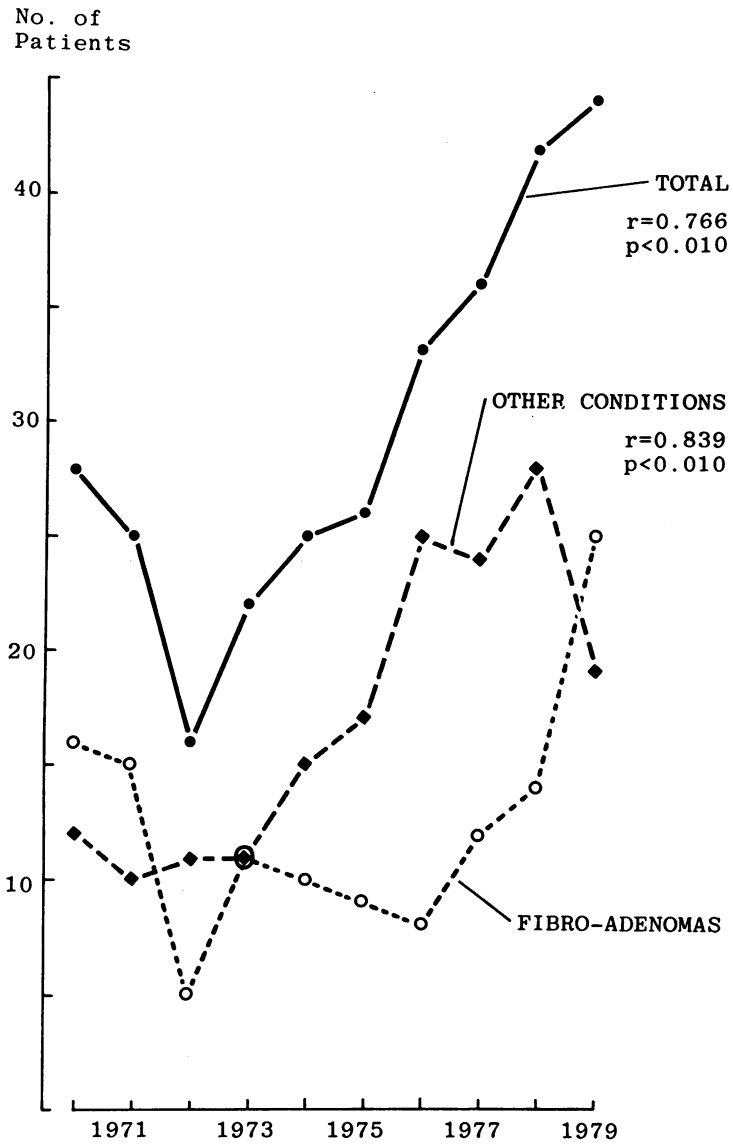

FIGURE 1
Annual number of patients with fibro-adenoma and other conditions r = Spearman rank correlation coefficient.

On the assumption that the number of fibro-adenomas biopsied does not vary significantly from year to year, this number can be used as an indicator of whether the population presenting with breast lumps is changing. With the exception of 1979 there is a noticeable and significant increase in the number of biopsies for conditions other than fibroadenoma. There were only three cases of carcinoma detected. Most of the remaining cases were diagnosed as showing various forms of fibro-cystic disease. Almost 70 per cent of the patients presented for treatment within three months of first noticing an abnormality.

In the second study there were 5926 patients who had been seen at screening clinics. 1329 of these were under 30 and these formed the study population. Of these women under 30, 92 (7.0 per cent) were noted to have abnormalities, only 8 (0.6 per cent) were referred to hospital and biopsy was undertaken in only 4 of them (0.3 per cent) (Table 2). Almost a quarter, therefore, of the patients attending the screening clinics were under 30 years of age and this is the result of the mobile unit visiting areas where there are businesses and offices employing many younger women.

TABLE 1

Table of Pathological Diagnosis

Diagnosis	*No.*
Fibro-adenoma	106
Fibro-adenosis	85
Fibro-cystic disease	21
Combinations of above	26
Miscellaneous	28
Carcinoma	3

TABLE 2

Screening Clinic Results

Total patients seen	5926
Total women under 30	1329
Total with abnormalities	92
Hospital referrals	8
Biopsy undertaken	4

The records of the 92 women in whom an abnormality was detected were examined. The abnormality noted ranged from a diffuse thickening to a definite lump. Most of them were reviewed before being referred to a hospital clinic, with the consequence that only 8 with a discrete persistent mass were eventually sent for a further opinion. Amongst those that were not referred were 22 who had previously proven breast disease, ranging from infections to benign lumps operatively removed. Of those referred to hospital only half (4) had biopsies and all of these were benign.

At the end of each patient's visit to these clinics, the patients were taught self-examination of their breast and encouraged to continue doing so.

DISCUSSION

Breast cancer is very unusual in women under 30. The Registrar-General's reports for England and Wales[2] show an annual death rate from breast cancer which averages 11,000 and of these only about 30 are under the age of 30. Equivalent figures in Northern Ireland show that no woman under 30 died in the years 1970-77 from breast cancer and this study revealed only 3 cases in the decade 1970-79 in this hospital. All these are alive at present. Nevertheless an increasing number of young women are having excisional biopsies of benign breast lumps. However, it must be assumed that the pattern of breast disease in young women is unlikely to have altered between 1970-1979 and this suggests that the indications for breast biopsy are changing and becoming much wider. The only lumps that need to be removed are the fibro-adenomas and carcinomas and these do not seen to have changed in hospital incidence. It is clear therefore that the increasing number of breast biopsies are carried out for diffuse disease which is likely to regress spontaneously.

It is difficult to ignore a breast lump once it has been noticed so the progression from detection to excision may become inevitable. No other diagnostic technique

can exclude carcinoma satisfactorily and surgeons are afraid of missing an early carcinoma. However, the clinical signs of fibro-adenoma and carcinoma do differ very significantly from those of the cyclical changes in the breast of young women and avoidance of unnecessary surgical excision is also a desirable aim. These young women attend for reassurance and there are probably many patients for whom authorative reassurance would avoid the necessity for breast biopsy and in whom a period of observation would confirm the disappearance of the abnormality.

In the last few years there has been much publicity, both in the commercial press and in various agencies for health education, to encourage women to attend screening clinics and to examine their own breasts regularly. Often no distinction is made between young and old women or if it is made it is not emphasised. The consequence is that many young women, often in their teens. feel they must examine their breasts regularly and become apprehensive about the prospects of developing malignant disease of the breast.

Benefits to young women of screening clinics for breast cancer must be looked at critically. Published results of screening have usually had a lower cut off age of 40-45 years as the low risk in young women is well recognised and the results of the HIP[1] study fail to show benefits of screening in young women. In 1976 the Edinburgh Family Planning Clinic[3] reported on routine breast examination in young women concluding that it had no merit and that such examination should be restricted to women over 40 years.

Several conclusions can be drawn from this paper. Firstly, the increasing number of breast biopsies being performed on young women in this hospital is related to biopsies for benign, diffuse disease and a more critical attitude could reduce this number of biopsies without any risk to patients. Secondly, there is no great delay in women presenting for a medical opinion when they do notice an abnormality in the breast. Thirdly, there is no benefit from screening young women nor in suggesting that they should carry out regular breast self examination. Anxiety generated by such a policy is not compensated for by any therapeutic advantage.

As a result of this study Action Cancer have decided that they will no longer screen breasts of women under 30 years except in the case of a specific complaint. Family planning clinics and well woman screening clinics should also cease to examine the breasts of women under the age of 30.

SUMMARY

The number of breast biopsies performed on women under 30 years of age has been increasing in this hospital in recent years. A survey of a local cancer screening clinic involving 5926 patients, revealed that 1329 were under 30 years of age and only 8 of these were subsequently referred for a surgical opinion. Only 4 of these had a formal biopsy. The clinic has altered its policy and abandoned routine examination of breasts in under thirties. It is suggested that this policy should be widely accepted to allay anxiety in young women.

ACKNOWLEDGEMENTS

We would like to thank the Director and Staff of Action Cancer and the Medical Records Department, Royal Victoria Hospital, for all their assistance.

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IS PERSISTENT OPACIFICATION OF THE GALL BLADDER ON CHOLECYSTOGRAPHY AN INDICATION FOR CHOLECYSTECTOMY?

by

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THERE is a widespread reluctance amongst surgeons to undertake cholecystectomy on the basis of symptoms alone. These views derive from early studies suggesting an unacceptable incidence of the post-cholecystectomy syndrome in such cases.[1] There is however, a well recognised group of patients with typical biliary tract symptoms and normal oral cholecystography ('stoneless symptoms') who pose considerable management problems. It has been suggested that the persistence of contrast medium in the gall bladder on a straight x-ray taken 24 hours after an otherwise normal cholecystogram is a reliable index of gall bladder dysfunction.[2] Whilst more sophisticated techniques of demonstrating gall bladder function exist these are not universally available, outside specialist centres. The concept, that the simple, inexpensive, addition of one further x-ray, 24 hours after normal oral cholecystography might help to select out those with genuine gall bladder pathology, has considerable clinical appeal. The reliability of persistant opacification of the gall bladder in discriminating gall bladder pathology in the absence of calculi, has been assessed in a small series of patients.

PATIENTS AND METHODS

Between January, 1977 and December, 1980 twenty patients underwent cholecystectomy on the basis of convincing symptomatology and persistent opacification of the gall bladder. From an earlier review of the details of all patients undergoing cholecystectomy over this period, a comparable age/sex matched 'control' group was selected from those who underwent cholecystectomy on the traditional criteria of cholelithiasis. A data base was collected from careful review of case records, including operation notes, supplemented by a detailed questionnaire. The pathological diagnoses of the removed gall bladders were scrutinised by one pathologist. Complete sets of data were obtained on all patients with pursuit of equivocal details by a combination of telephone enquiry and home visit.

Mean values are accompanied by their standard deviations. Continuous variables were analysed by Student's paired t-test. Discontinuous variables were analysed using Chi-squared for discordant pairs.

RESULTS

Of the 20 gall bladders (17 female and 3 male) removed on the basis of delayed emptying (DE), 12 were reported as pathologically abnormal (DEpos) and 8 normal (DEneg). All the control group had abnormal pathology. The statistical analysis was conducted in two groupings. The 12 DEpos patients and 8 DEneg were separately

compared with their age/sex matched 'controls'. The mean ages in years were DEpos 40.2 ± 9.4 (control 40.0 ± 9.4), DEneg 37.3 ± 12.3 (control 37.5 ± 14.1).

Pre-operative symptomatology

The duration of pre-operative symptoms was significantly longer in the delayed emptying group of patients (regardless of the ultimate pathology of the gall bladder) than controls. DEpos = 93.5 ± 80.7 months; controls = 39.8 ± 36.6 months ($t = 2.18$, $P = 0.05$). DEneg = 72.8 ± 44.7 months, controls = 31.6 ± 22.6 months ($t = 2.16$, $P = 0.06$). Analysis of individual symptoms (Table I) revealed no difference in the type or distribution of pain between the groups. The incidence of nausea, flatulence, fat intolerance and heartburn was similar in the DEpos group and its controls. However, there was a pronounced difference in the incidence between the DEneg group and its controls.

TABLE I

Pre-operative symptomatology

	DE pos.	*Control*		*DE neg.*	*Control*	
PAIN						
Type: Constant	6	5	$Chi^2 = 0.11$	4	2	$Chi^2 = 1$
Colic	6	7	($P > 0.7$)	4	6	($P > 0.3$)
Site: Epigastric alone	1	2	$Chi^2 = 2$	0	1	$Chi^2 = 0.3$
Epigastric radiating	3	6	($P > 0.1$)	5	4	($P > 0.5$)
R. Subcostal radiating	8	4		3	3	
Nausea	9/12	8/12	$Chi^2 = 0.2$ ($P > 0.5$)	8/8	5/8	$Chi^2 = 3$ ($0.05 < P < 0.1$)*
Flatulence	9/12	9/12	$Chi^2 = 0$	8/8	5/8	$Chi^2 = 3$ ($0.05 < P < 0.1$)*
Fat intolerance	10/12	8/12	$Chi^2 = 0.66$ ($P > 0.3$)	7/8	4/8	$Chi^2 = 3$ ($0.05 < P < 0.1$)*
Heartburn	6/12	7/12	$Chi^2 = 0.2$ ($P > 0.5$)	3/8	5/8	$Chi^2 = 2$ ($P > 0.1$)

Investigations

The traditional reluctance to accept symptoms as biliary in origin in the absence of demonstrable calculi or non-function, was reflected in the higher number of pre-operative investigations in the delayed emptying group. Twelve of the delayed emptying group had one normal oral cholecystogram prior to the series showing persistent opacification of the gall bladder; the remaining eight patients in the group had two such normal oral cholecystograms. Intravenous cholangiograms were also performed in two patients and ultrasound scan in one patient of this group with no abnormalities detected. The reliance on intravenous cholangiography as the alternative biliary tract investigation is a reflection of the time span of the study when ultrasound scanning was not as established as at present. Predictably more non-biliary investigations such as barium meal, gastroduodenoscopy, barium enema, IVP were also performed in the delayed emptying group. A total of 25 such investigations were performed on the 20 patients, compared to eight in 20 control patients.

Operative features

In the delayed emptying group there was poor correlation between the appearance of the gall bladder at surgery and the subsequently reported pathology. Ten out of the twelve pathologically abnormal delayed emptying gall bladders were considered macroscopically normal by the surgeon. Despite their non-visualisation on pre-operative cholecystography, small calculi were discovered in two of the DEpos and one of the DEneg gall bladders. Per-operative cholangiography was performed in all cases and exploration of the common bile duct undertaken in four control cases but in none of the delayed emptying group.

TABLE II

Patient assessment of surgical outcome

	DE pos.	*Control*		*DE neg.*	*Control*	
Visick Grade:						
1 = Complete cure	5	4		1	4	
2 = Better but not perfect	6	8	$Chi^2 = 0$	6	4	$Chi^2 = 2.6$
3 = Unchanged	1	0		0	0	($P > 0.1$)
4 = Worse	0	0		1	0	
Pre-operative symptom score	9.1 ± 2.5	7.3 ± 2.8	t = 1.42 (P = 0.18)	9.8 ± 1.8	7.8 ± 3.2	t = 1.56 (P = 0.163)
Post-operative symptom score	3.6 ± 3.6	2.8 ± 2.7	t = 0.59 (P = 0.57)	4.1 ± 3.4	1.9 ± 1.8	t = 1.48 (P = 0.183)

TABLE III

Post-operative symptomatology

	DE pos.	*Control*		*DE neg.*	*Control*	
Post-operative symptoms						
Pain	6/12	3/12	$Chi^2 = 1.28$ ($P > 0.2$)	5/8	0/8	$Chi^2 = 5$ ($P < 0.05$)*
Nausea	4/12	2/12	$Chi^2 = 1$ ($P > 0.3$)	3/8	1/8	$Chi^2 = 1$ ($P > 0.3$)
Flatulence	5/12	8/12	$Chi^2 = 1.28$ ($P > 0.2$)	7/8	3/8	$Chi^2 = 4$ ($P < 0.05$)*
Fat intolerance	4/12	4/12	$Chi^2 = 0$	3/8	2/8	$Chi^2 = 0.2$ ($P > 0.5$)
Heartburn	1/12	2/12	$Chi^2 = 0.3$ ($P > 0.5$)	1/8	4/8	$Chi^2 = 1.8$ ($P > 0.1$)

Post-operative course

Post-operative complications were unremarkable; there was no wound sepsis or thromboembolism and only one instance of chest infection in a control patient. The duration of admission was shorter in the delayed emptying groups; DEpos 12.3 ± 3.3 days, controls 13.4 ± 5.1 days (t = -0.62, P = 0.54) DEneg 11.9 ± 0.8 days, controls 13.3 ± 2.1 days (t = 2.2, P = 0.06). A 'Visick type' grading of the

patients subjective assessment of surgical outcome suggested that both the DEpos and DEneg groups benefited from cholecystectomy (Table II). However, analysing specific symptoms revealed a higher incidence of residual symptoms in the DEneg group compared to DEpos and controls (Table III). The patients were asked to grade, pre and post-operatively, each of five specific symptoms, on a severity scale of 0-3. Pre and post-operative symptom score totals were then compared and a statistical evaluation made of the effect of cholecystectomy in reduction of sympton intensity (Table II). The delayed emptying group had higher pre-operative symptom score totals than controls. Surgery reduced the symptom score totals in all groups; however, the DEpos group appeared to derive more symptomatic benefit than the DEneg group.

DISCUSSION

Visualisation of gall bladder calculi or non-function are the established indications for cholecystectomy. There is, however, a sub-group of patients with convincing biliary tract symptomatology. but no evidence of pathology on cholecystography. These patients pose well recognised and difficult management problems. They tend to undergo multiple investigations, in an attempt to define alternative aetiologies for their symptoms. Repeated oral cholecystography is often performed in the anticipation that calculi will be reported eventually.

Some doubt is being thrown on the traditional reluctance of surgeons to perform cholecystectomy on symptomatic grounds alone.[3,4] It is too simplistic to link gall bladder pathology exclusively to the presence of calculi; clearly gall stones represent the end point of an evolving disease process. "Stoneless symptoms" are just as real as symptomless stones. Until fairly recently oral cholecystography introduced by Graham and Cole in the 1920's remained the major imaging technique. However, its limitations are considerable; it fails to diagnose 2-10 per cent of patients with calculi especially if supine and erect views are not taken.[5] It is essentially a static gall bladder imaging technique and even when accompanied by a fatty meal fails consistently and reliably to demonstrate dynamic gall bladder function. Attempting to demonstrate persistant opacification endeavours to extend the role of the oral cholecystogram from a purely static to a functional dynamic imaging technique. In this series the technique accurately discriminated gall bladder pathology in 12 out of 20 patients, 60 per cent. The eight patients with normal gall bladder pathology might at first sight seem to be false positives for the technique. However, one of the group did have calculi and all the patients did claim benefit from surgery. It is possible that they represent some form of biliary dyskinesia. The term 'irritable gall bladder' has been coined for this disorder[6] and one study has suggested that narrowing and kinking of the cystic duct is the underlying problem.[7] Spasm of the sphincter of Oddi has also been incriminated.[8]

More sophisticated techniques of dynamic gall bladder imaging are now available. The effect of cholecystokinin on the opacified gall bladder can indicate functional abnormalities.[9] Radio-isotope hepatobiliary scanning with Technetium 99m labelled H.I.D.A. provides objective quantitative data on gall bladder function[10] but is not widely available outside specialist centres.

The results of this limited retrospective experience suggest that demonstration of persistant opacification of the gall bladder may aid the selection of patients for

surgery from this group with "stoneless symptoms". A prospective study is in progress involving HIDA scanning of all patients demonstrating persistant opacification of the gall bladder and it is hoped this may provide further insight into the phenomenon.

SUMMARY

Twenty patients with symptoms highly suggestive of gall bladder disease but with normal routine cholecystograms, were subjected to cholecystectomy on the basis of delayed emptying of the gall bladder. This was defined as persistence of the contrast medium in the gall bladder 24 hours after the normal cholecystogram. Twelve of the gall bladders removed were pathologically abnormal, and two of these contained stones. One of the eight gall bladders reported pathologically normal also contained small calculi. The outcome in these patients was compared with age and sex matched controls with proven stones on cholecystography; the results of surgery were satisfactory in the two groups. It is suggested that evidence of delayed emptying on oral cholecystography may provide some further help in deciding on surgery in patients with typical symptoms but normal cholecystogram.

ACKNOWLEDGEMENTS

We are most grateful to Dr. Denis O'Hara for scrutinising the pathological diagnoses and to Mr. Gilbert McKenzie for statistical advice.

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BOOK REVIEWS

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Before reading the book I wondered about the concept of two non-experts writing a book on neonatal care. Perhaps as tyros they would be able to see the wood behind the trees created by 'neonatal paediatricians.' Alas no, this book which is directed primarily at undergraduate students and senior nurses fails because it lacks the balance which comes with experience. Thus in chapter two, The Delivery Room, resuscitation of the newborn is described without mentioning the Apgar score. In contrast inborn errors of metabolism are covered in the full five pages of chapter 11 on Metabolic Problems. The text is broken up by numerous lists which makes the book very difficult to read. I shall continue to advise medical students and midwives who wish to read a short introductory text of newborn care to opt for "The Newborn Child" by DG Vulliamy.

HLH

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RWS

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Management advice is often impractical. In cases of accidental poisoning the recommendation that "Vomiting can be induced by sticking one's fingers down the back of the child's throat" is not likely to appeal to many general practitioners. Nor is the suggestion that palpation for a tumour in a suspected case of hypertrophic pyloric stenosis be preceded by emptying the stomach using a nasogastric tube.

Though the purpose of this book has considerable merit its overall objective has sadly not been achieved.

IJC

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Although students will need to refer to larger texts in their private study, these comprehensive books are highly recommended to medical students in their practical anatomy classes where dissection and observation with minimum reading is so necessary. They are also good value, pocket size, and light in weight.

TJH

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The work consists of a series of clinical and X-ray photographs illustrating diagnostic physical signs of child abuse, as well as some of conditions which often simulate the true diagnosis. Also included are cleverly-staged pictures of children which are often good enough to portray the anxiety, memories and emotion which surround their unhappy recent experiences. Associated with the colour photographs, most of which are of high quality, is a succinct summary of the procedural steps which should be taken to document adequately the physical signs. How to proceed from this point until the child is discharged from hospital is also dealt with in brief. But it is in the arresting pictures that the value of this publication lies.

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Though the purpose of this book has considerable merit its overall objective has sadly not been achieved.

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Although students will need to refer to larger texts in their private study, these comprehensive books are highly recommended to medical students in their practical anatomy classes where dissection and observation with minimum reading is so necessary. They are also good value, pocket size, and light in weight.

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The work consists of a series of clinical and X-ray photographs illustrating diagnostic physical signs of child abuse, as well as some of conditions which often simulate the true diagnosis. Also included are cleverly-staged pictures of children which are often good enough to portray the anxiety, memories and emotion which surround their unhappy recent experiences. Associated with the colour photographs, most of which are of high quality, is a succinct summary of the procedural steps which should be taken to document adequately the physical signs. How to proceed from this point until the child is discharged from hospital is also dealt with in brief. But it is in the arresting pictures that the value of this publication lies.

This is a well-produced book of less than 60 pages and surely it should be among the standard books in every paediatric unit, community health clinic and family doctor's surgery.

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JV-O

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PROBLEMS IN ARTHRITIS AND RHEUMATISM. By Douglas N Golding. (Pp 160, Illustrated. £7.95). Lancaster, Lancs: MTP Press, 1981.

THIS is the most recent of a series of general practitioner handbooks covering medical specialities and designed to be practical and short in compass.

Dr. Golding is an experienced author (and rheumatologist) and has put a great deal of his widely based knowledge into this manual. Recognised difficulties in the classification, diagnosis and therapy of the common rheumatic states are presented largely in note form with marginal headings and there is appended a very useful glossary to cover briefly the less common rheumatic disorders. The section on the psychogenic aspects of the rheumatic disease is particularly commended.

Of necessity, the book tends to be dogmatic and in it, the author makes a gallant attempt to give guidance as to when the patient should be referred to the rheumatologist. The advice on joint aspiration and injection is sketchy and unlikely to lead to success. In most circumstances, such procedures are best undertaken in hospital.

This is a very practical, readable book which will be a reliable guide not only to the general practitioner but junior medical staff and students will benefit from reading it. MJWB

PAEDIATRIC EMERGENCIES—A Practical Guide to Acute Paediatrics. By Tom Lissauer. (Pp 328, Figs 14. £12.95). Lancaster, Lancs: MTP Press, 1982.

AT a recent meeting of the Ulster Medical Society in which I took part entitled "Paediatric Emergencies" it was interesting to see how doctors from different branches of the medical services for children interpreted the word—'emergency'. From a family doctor's night call for otitis media to the life-threatening stridor of acute epiglottitis in an intensive care unit.

Now here is a book which deals specifically with such emergencies which can be recommended for junior paediatric doctors, accident and emergency department staff, general practitioners and senior medical students. The emphasis is upon diagnosis and management of paediatric emergencies, and the approach is essentially practical. Several chapters had been published previously as individual articles in *Hospital Update,* but these have been extensively revised and a number of new chapters added. Topics dealt with include—neonatal resuscitation, cardiorespiratory arrest, stridor, diarrhoea and vomiting, acute abdominal pain, diabetic ketoacidosis and hypoglycaemia, the febrile child, convulsions, coma and shock. Accidents and poisonings, sudden infant death syndrome and child abuse are also included.

The book is detailed in giving instructions regarding emergency room and bedside management and includes an excellent chapter on practical procedures. It is well illustrated with tables, clinical photographs, management flow diagrams, x-rays and schematic drawings. There are several appendices, one of which sets out recommended doses of useful drugs in children of various ages.

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GERONTOLOGY AND GERIATRIC NURSING, Sir W Ferguson Anderson, FI Caird, RD Kennedy and Doris Schwartz. (Pp viii + 215. £3.95). London: Hodder and Stoughton, 1982

THIS short book is written by three eminent geriatric physicians and an American academic nurse. The title is rather misleading as it is really a textbook of geriatric medecine for nurses. Only one chapter deals with the ageing process and practical nursing advice is often scanty. However, it is a clearly written book which gives a good medical background for nurses working with elderly people. Particularly good chapters include the care of old people in the community, incontinence and the importance of drugs and their administration. I would like to have seen a more extensive discussion of the practical and moral issues which arise in managing terminally patients. Also one might argue about small points like the choice of chlorpropamide as the first choice oral hypoglycaemic drug. It is a well written useful book for nurses and possibly other paramedical personnel, but it is not really aimed at doctors. Also, at a price of £3.95, it represents a real bargain.

HT

GERM CELL TUMOURS. By CK Anderson, WG Jones and A Milford Ward. (Pp xxi + 427; Illustrated. £18.00). London: Taylor and Francis, 1981.

THIS book consists of a series of papers delivered to a Conference on Germ Cell Tumours held at The University of Leeds, March, 1981. There are 54 contributions from a variety of authors. All the well-known names in the field are represented and the sections are divided into the recognised divisions of pathology, epidemiology, treatment etc. There is a very useful section on tumour markers which are especially important in some of these lesions, including malignant teratoma of the testis.

Germ cell tumours are rare and account for less than 1 per cent of cancer. Yet they are surprisingly common in the day-to-day clinical experience of the radiotherapist or oncologist. Even so it is unusual to discuss the various features of these lesions in a single volume, perhaps because the anatomical location varies from the skull to the pelvis. Nonetheless it is this unified approach which is the most valuable aspect of this book.

Inevitably in a multi-author work, the contributions are slightly uneven but the book is one of the most valuable volumes on our departmental bookshelf. It is recommended without reservation to all those involved in this field.

WSL

A SHORT TEXTBOOK OF MEDICINE, Seventh Edition. By JC Houston, CL Joiner and JR Trounce. (Pp 772. £7.95). London: Hodder and Stoughton, 1982.

THIS short textbook of medicine originally appeared almost twenty years ago and it has been revised and rewritten many times. In fact, the sixth edition was published as recently as 1979. This seventh edition is really an entirely new book with three new contributors joining the original team.

Although the size of the book has increased by some 100 pages, it is still remarkable how much information is contained in its comparatively small size, and included now is a new chapter on Tropical Diseases and Infestations which has become so necessary with the increase and speed of world travel.

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JV-O

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