Middle Articles

CONTEMPORARY THEMES

Sub-specialization or Super-specialization in Surgery?

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British Medical Journal, 1970, 2, 719-722

Summary: A special centre for prosthetic hip replacement set up 10 years ago has been successful in its primary objectives, producing high quality work at low cost and stimulating research. The project has not yet been successful in achieving a permanent staffing structure, but this is the effect of certain British ideologies in surgical training, with the result that craftsmanship and technology cannot be reconciled with pure intellectual attainment.

The success of the project suggests the importance of isolating elective surgery from emergency surgery in the interests of cost-effectiveness. Problems of isolation from teaching hospitals are not insurmountable, but isolation to some degree is essential to achieve the minimum size necessary for efficiency and to ensure unbroken professional team-work among all levels of staff. While maximum efficiency in this field can be achieved only in special centres, too many primary operations will be required every year to insist that total hip replacement should be done only in special centres. A special feature of this field is the need for a permanent staffing structure to hand on technical expertise as an unbroken tradition.

A new surgical science—total prosthetic joint replacement—has suddenly come into being. I shall attempt to defend the thesis that it possesses sufficient intellectual breadth and general importance to make it worthy of a full career.

As early as 1959 my interest in total hip replacement convinced me that it was essential to discover whether certain pathological reactions in the tissues were the result of implanted plastics or of mild bacterial infection. Without an answer to this question an important new development might be widely copied and acquire a bad reputation before being soundly tested. Moreover, the studies would have to be done in man because they would have to involve bipedal gait and subjective assessment of the results. Nevertheless, plainly a large series of patients would have to be studied, and they could never be accommodated in a teaching hospital. The solution lay in a country tuberculosis hospital of some 200 beds, where there was a long-standing orthopaedic tradition established from Manchester by Sir Harry Platt and from Liverpool by Professor Macmurray. Chemotherapy and better social conditions had emptied many of the beds, and it was obvious that the then projected new M6 motorway would end the hospital's isolation and put it within three or four hours by road from London or from Glasgow.

By 1962 the special centre started at Wrightington for hip surgery, supported by the Manchester Regional Hospital Board Research Committee, was showing such signs of success that I resigned from the teaching hospital in order to become geographically whole-time. My surgical colleagues had already given me three years' leave of absence because they did not

think that my project was viable, predicting that the hospital was too inaccessible to attract staff and patients. Even so, events proved that patients will go any distance for elective surgery if they have confidence in the reputation of a unit.

Super-specialization

There are four special features of reconstructive hip surgery which strongly favour super-specialization.

Numerical Size of the Problem.—As a result of field surveys in two communities, Kellgren and Lawrence (1961) estimated the incidence of arthrosis of the hips. There are probably between 100,000 and 200,000 patients in Britain with hip arthrosis which is suitable for reconstructive surgery. This total includes a backlog, comprising patients in age groups which would have been regarded as outside surgical consideration before the introduction of this new technique. It also includes 10,000 to 20,000 new patients who fall into the surgically remediable category every year. Moreover, these figures relate only to osteoarthritis and might be augmented by 25% if rheumatoid arthritis and the late effects of trauma were to be added. At the very least these figures indicate the potential necessity for about 12,500 total hip replacements in Britain each year.

A heavy work-load therefore has suddenly been created in response to the availability of a successful new operation. This new work-load is not merely the transfer of patients from one type of operating-list to another, because early forms of arthrosis suited to the standard operation of osteotomy have not been included in these estimates. Thus the orthopaedic departments planned for the future district general hospital will be unable to cope if they are to handle the routine orthopaedics for which they were designed.

Humanitarian Considerations.—The pain and disability caused by osteoarthritis of the hip are frequently extreme. Many patients are elderly widows living alone; often dependent on neighbours for shopping and other help, they may yet have 10 years of life ahead. Their infirmity is often accentuated by fear of total dependence on strangers in the near future. These patients can be rendered happy and self-supporting by total hip replacement after less than four weeks in hospital. Such success, furthermore, produces a chain-reaction, and the problem is now how to advise patients against total hip replacement if their condition is not bad enough for this radical step.

Avoidable Complications.—The one postoperative complication after total hip replacement which ties a surgeon's hands is deep wound infection. Whereas in general surgery a 2% infection rate with mild organisms is usually insignificant compared with the risks of the disease for which the operation was undertaken, in total prosthetic joint replacement the mildest of deep infections spells failure. Moreover, in a centre such as Wrightington, where some 1,000 arthroplasties are

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performed each year, a 2% infection rate would result in 20 infected hips a year. Each of these patients would occupy a bed for about three months, and, in addition, perhaps another five infected inpatients would be present as readmissions from previous years. Thus such a 100-bedded unit could well have 15 to 20 beds always occupied by patients with wound infection. On a national scale a 2% infection rate in 12,500 operations yearly would mean at least 250 new infected cases each year. Special centres devoted to total prosthetic replacement, on the other hand, can install special operating-room enclosures. Though in general hospitals these special installations might be superfluous, they could be kept in continuous use by the concentration of the work-load. While one cannot pretend that postoperative wound infection is as yet entirely within the surgeon's control, at Wrightington we have certainly reduced it to under 1% by technical precautions in the operating room.

Organization and Costs.—It is possible to ensure that six operations can be performed between 9 a.m. and 6 p.m. in one operating-room. Operating times average about one and a quarter hours per case against perhaps more than two and a half hours in units not completely geared to these techniques. Cost is obviously related to the number of operations which can be performed in a day. Saving of fatigue and harassment of nursing staff by good organization makes it possible to repeat operating sessions like this four times a week. This degree of productivity is achieved by grading cases according to their technical difficulty and the resident staff according to their stage in technical training. One consultant, one senior registrar, and three registrars can readily perform 24 operations a week (or about 1,000 a year) in one operating-room, at the same time maintaining high standards of patient care. In addition most residents find time for research projects in the evenings because of the absence of emergency work and because of the reduction of time consumed by inefficient work in the wards.

Documentation and Staffing

Not only does accurate documentation help research but it also increases the efficiency of the unit by saving time. Hip surgery lends itself well to the use of forms, thus reducing the time wasted in handwriting and in typing. Data in these forms can be represented by an alphabetical and digital code and transferred to punch cards and processed by clerical staff with minimal knowledge of medical terminology.

Because it is difficult to predict whether and how artificial hip joints will eventually fail, it is important to make provision to deal with this. Moreover, secondary operations will need more technical expertise than primary ones. So many operations will be needed that most of them will have to be performed in general orthopaedic departments throughout the country. Hence I visualize the establishment of a limited number of special centres such as this at Wrightington (1) to train postgraduates in the technology, (2) to take problem cases referred for special reasons, and (3) to cope with secondary operations. It is essential that technical skill acquired by members of the staff of a special surgical centre should be handed on continuously so as to keep a body of men capable of handling the difficult secondary operations of the future.

Isolation

The commonest criticism of this unit is the idea that isolation from a main teaching complex will damage the intellectual calibre of the staff. Some degree of isolation, I believe, is inevitable; the problem is how to accept it and how to ameliorate its defects. Without isolation this unit could never have started, and without isolation it could never have attained the size necessary to achieve efficiency on a pro-

ductivity basis. Many of the criticisms of isolation in this ultraspecialized unit are not as sound as they appear at first sight. In a great teaching hospital the isolation of different "firms" in different specialties can be quite astonishing, even though separated by only fifty yards of corridor. In a teaching hospital surgeons rarely have time to drop into the next-door operating-theatre for intellectual refreshment. To observe a new technique in his own teaching hospital a surgeon must plan a week ahead, and this visit could have been arranged a few miles away just as easily. Furthermore, my experience indicates that it takes no longer to get the opinion of a consultant in another specialty from the Wigan Infirmary 6 miles (3.7 km.) away than from one just up the corridor in a teaching hospital.

Undoubtedly, the most serious argument against physical separation of highly specialized units is the domestic happiness of resident surgical staff. Unless a specialized unit is big enough to carry a large resident staff, in the evenings and at weekends wives and children may have a difficult time, especially if young married men are uncertain and worried about their future careers. These latter suffer badly if they are incapable of becoming absorbed in a research project outside the day's work. Fortunately the realization that six months in this highly specialized field is adequate to acquire the basic skills has relieved this difficulty, but the position could still be improved if our unit could set up rotating schemes with the teaching hospitals.

Optimum Size

A minimum size must be achieved before a special unit can be efficient and self-maintaining. My experience suggests that this centres on the operating-room staff. The operating-theatre should be the bottleneck. A single operating-room is not efficient, because of time wasted at changeover between cases. Two operating-rooms, if used as separate units, are twice as inefficient as one. The most efficient deployment of theatre staff is to have two operating-rooms but to use these as *one and a half*; the second room is used to start the next case but not to do the same amount of work in a day as the first operating-room. For maximum efficiency two anaesthetists must be present simultaneously—a situation which fits in very well with one consultant and a trainee.

In one operating-room we currently perform six hip arthroplasties a day, but with one and a half operating-rooms the same nursing, surgical, and anaesthetics staff could turn out nine cases a day. This permits four days' surgery a week, with one day for operating-room recuperation. The ideal staff would comprise a senior consultant, a junior consultant, three residents of senior registrar grade circulating on a six-month basis with external units, and several foreign post-graduate Fellows. In this scheme the junior consultant would replace the first senior registrar; this would eliminate the disastrous situation when the most responsible appointment of senior registrar is vacated almost annually. This would not mean that the junior consultant would be of inferior status—or another name for a medical assistant—but merely that a unit of this kind needs two consultants working closely together.

To increase the size of the unit beyond this (corresponding to 100 beds) it would be necessary to double the whole unit to preserve the same efficiency. If doubled in size it would then have to be run as two parallel entities; but since the two halves of a double unit would not necessarily complement each other, there would seem little point in doubling the size of a unit in one location; this would be an argument for establishing two-consultant modules in relation to population in other sites. On the other hand, in a single unit there is much to be said for an increase in research staff (with another consultant) to study total joint replacement in other joints, such as the knee, shoulder, and elbow.

Ward Rounds

The unit must not be so large that the director cannot make personal contact with patients in the wards, even if only briefly. The major weekly ward-round attended by all senior personnel has an important influence on ward morale. With 100 beds the ward-round can be organized so that each of the 24 patients operated on during the previous week is seen, with radiographs, and the work of the residents is checked; this greatly reassures patients at this stage. Some of the wounds are scrutinized at random during this ward-round and all thromboembolic complications are discussed. Finally, all the patients due to return home before the next weekly ward-round are examined.

Admissions

To ensure that the quota of new admissions each week yields a full operating-list it is important that every week the consultant should see as many new outpatients as possible. The senior registrar should sit in on these occasions to be trained in this form of outpatient technique. Moreover, we compensate for the brevity of our outpatient consultations at the weekly staff conference. The only feature of this system which is uneconomic is that all patients must be admitted on a Monday so as to permit the cases to be fully worked up for the weekly staff conference on Wednesdays. This means that six patients will have to wait eight days before surgery (until the subsequent Tuesday); generally this is not a bad thing, since those who have to be delayed are chosen from those who would benefit from time to settle down.

Follow-up

The size of a hip unit must not be so great that the quality of the product cannot be scrutinized by follow-up. We have a permanent pilot study of the long-term patients, which we call the "first 500"; at the moment of writing this refers to patients between four and seven years after operation. These are seen every year, so far as possible by me. Every year this group slowly declines in number, because most of the patients chosen for this type of surgery seven years ago were of fairly advanced age, but we are adding more recent patients of special interest. This clinic of about 5 to 10 follow-up patients a week is of great interest for visitors, since it is unselected as regards the quality of the long-term material.

At the present rate of 24 operations a week it is impossible to see all patients after operation repeatedly over several years. We satisfy ourselves by seeing all patients at six months and then finally one year after operation. The six-month visit consists mainly in an x-ray examination and a social chat, except when some defect is present. At the one-year visit a complete physical examination is recorded, together with an x-ray film, and the patient is then discharged unless of special interest. Even this brief surveillance accounts for 48 weekly consultations by the resident staff; 24 of these cases will need careful examination and recording. The number of resident staff must be regulated to cope with this, but it must not be so large that each resident does not have adequate opportunities to gain surgical experience in the operating-room.

Conflict with Surgical Education

In the first seven or eight years of its life this unit was too unorthodox to be accepted in surgical training schemes. The only British residents we could attract were those for whom the job offered a good opportunity to read for the fellowship examinations. The essential problem has been, and still is, that these resident appointments are too specialized for men who have less general orthopaedic experience than would put

them in the running for a junior consultant appointment. For newly appointed senior registrars, still with a limited general orthopaedic background, the appointment is excellent for six months, and these men must then complete their general training elsewhere. Unfortunately for the unit continuity of staffing with a view to getting new consultants thus becomes difficult.

In my view it is essential that new consultants in this highly technical field should "come up from the shop floor." They should have been exposed to the atmosphere of the unit and have at least two years' technical training, by which time they will have shown whether or not they possess the natural technical skills for a team of this kind.

A specialized centre like this highlights one of the chief tragedies of the British medical system—namely, the powerlessness of senior consultants to plan the careers of their best pupils in the interests of the continuity of efficient treatment of British patients. Once a resident has spent a certain length of time in a specialized unit the system demands that he must be exposed to selection committees, and his specialized knowledge and skill may be wasted in another appointment. Frequently he will despair and accept an invitation to take his skills to North America, to be replaced by an unknown quantity who may dislocate the running of the unit.

Surgical Training

I would like to criticize some ideas in surgical training in Britain. The Royal Colleges have not yet found a formula to reconcile their obsession with a "broad background of general training" with the need to produce adequate numbers of highly competent surgeons to tackle the surgical treatment of hundreds of thousands of patients every year. Every decade the standards of theoretical training are raised and existing qualifications are denigrated. In 1935 the M.B., Ch.B. was a significant degree, and the F.R.C.S. the ultimate one could ever hope for. Today the F.R.C.S., with four years' delay in selected appointments before it can be taken, is insignificant and another four years in a specialty is demanded. Every decade fewer and fewer postgraduates are regarded as completely trained to do the work which patients need. Where and when is this process going to stop? This problem is especially serious in orthopaedics, because this field on top of general surgical training is too wide for all the literature to be mastered. Too wide a field results in knowledge being spread too thinly. It is a British characteristic to prefer amateurism to the intense approach which leads to professionalism; but it is only by encouraging professionalism, by narrowing fields of activity, that the quality of service can be raised and the cost per item lowered. If any shortage of technically competent surgeons exists it is, I believe, not so much the fault of the Health Service as of the Royal Colleges.

One fault in the training of surgeons at present is that eventually all surgeons pass the same postgraduate examination. This produces the situation where one candidate who has taken four or five shots to get his Fellowship will appear before an appointment committee the equal of another who got it the first or second time. In my view a higher percentage of men should be allowed to pass the fellowship examination, but passes should be graded into first- and second-class honours. It would then be up to the candidate to make sure he was fit to sit for first-class honours rather than "have a go" for experience. From the first-class-honours men one would expect to recruit the professors and the consultants who will be in charge of teaching units. It is from the second-class honours men that I would recruit the material to train for high levels of technical competence in a narrow specialty. These men would have opportunities to make up for what would appear to be lack of academic

distinction by the special facilities for research in a narrow field; when experience is not too thinly spread there are great possibilities for men of average calibre making important contributions to surgical science. Seen from this angle the surgical specialist is in no way an inferior grade of consultant; he is doing something which an ordinary consultant is not so competent to do, and on these grounds his responsibility and his salary should be the same.

As standards of living rise more surgeons and more nurses of quality are needed in proportion to the population than were needed in the past. Nevertheless, the proportion of persons in the population who are nurses and doctors by vocation is presumably constant and not capable of being artificially increased. There is only one solution, and that is to break down responsibility into narrow fields to suit the temperaments or educational levels of a broader spectrum of available persons. When the scope of a subject is narrowed, length of experience leads to penetration in depth, and this brings technical skill and efficiency.

This is not mere theory; it has been proved in practice and is well demonstrated in the nursing and ancillary staff at Wrightington, where, as elsewhere, nurses of State-registration level are always in short supply. But because the spectrum of conditions to be treated is narrow ancillaries are enabled to master their duties and, instead of being haunted all day by uncertainty and fear of reproof, they become confident and happy and develop pride and self-respect as part of a successful team.

The influence of this principle is seen particularly strikingly in the operating-room. This high standard is one of the reasons why new surgical residents immediately turn out first-class surgery, because they are supported by a professional team which is not subject to continuous change. Our first experiment with auxiliaries was to help our physiotherapists by using female orderlies in the non-technical aspects of their work. When elderly patients merely need somebody to walk by their side in the later stages of reha-

bilitation these ancillaries release physiotherapists to concentrate on other patients in the early stages of rehabilitation.

Interdisciplinary Contacts and the Future

Much of the future of medical science waits on the bridging of gaps between different disciplines. Orthopaedic surgery, with its probes towards mechanical engineering, with corresponding probes of engineering science towards surgery, is a notable example. In our centre we have established communications with the obvious related disciplines—engineering and plastics chemistry. Projects in these fields are available for residents inclined in those directions. Other research problems are those relating to thromboembolic phenomena (which are now emerging as the most common and serious complications of modern surgery) and to wound infection, both of which have a constant practical bearing on routine surgery in this field.

Efforts are now being made for our resident appointments to be held for periods of six months by senior registrars based on teaching units throughout the country, but this involves administrative problems and depends on achieving goodwill and collaboration. It must be emphasized that, though the declared purpose of this unit is to teach the technology of total hip replacement, the attitude of mind towards any surgical operation involving engineering principles is the same in many other fields of surgery. Hence time spent here should not be taken to imply that a postgraduate is necessarily considering a permanent commitment to hip surgery. In the same way, but in reverse, we are ready to make contact with non-conforming minds, since this helps us to see our established techniques through non-committed eyes.

REFERENCE

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MEDICAL HISTORY

Mark Akenside, 1721-70

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British Medical Journal, 1970, 2, 722-724

A modern doctor transported by his informed imagination to the wards of an eighteenth-century hospital finds himself in strange surroundings. He sees curious medicaments and barbaric procedures, smells the total lack of hygiene, hears the groans of the disfigured survivors of bloody operations, and in the centre of this extraordinary scene he finds the eighteenth-century physician.

"One leg of Doctor Akenside was considerably shorter than the other, which was in some measure remedied by the aid of a false heel. He had a pale strumous countenance, but was always very neat and elegant in his dress. He wore a large white wig and carried a long sword. I never knew him to spit, nor would he suffer any pupil to spit in his presence."¹

Mark Akenside was born at Newcastle upon Tyne on 9 November, 1721. His father, also Mark, and his mother were devout Presbyterian dissenters, so that after early schooling at the Free School of Newcastle young Mark was sent to the

private academy of a dissenting minister. It was while he was at this academy that Akenside showed the first promise of unusual talent by composing a poem which was published in *The Gentleman's Magazine*. The poem was "The Virtuoso," written "in imitation of Spenser's style and stanza," and its publication in 1737 was followed by the appearance of other poems by Akenside in the same journal.

The Poet

The brightness of the young poet's mind had not escaped the notice of the Presbyterians of Newcastle, and when he went to Edinburgh in 1739 to study for the ministry he was given financial assistance by the Dissenters Society. Akenside studied theology for one winter only, then changed to the study of medicine. There is no record of why he decided not to be a minister of religion, but even at the age of 19 Akenside had a sceptical turn of thought. In 1739, in his poem "Hymn to Science,"² he wrote:

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