Recent Advances

Orthopaedic and trauma surgery

Christopher J K Bulstrode

Over the past few years there have been enormous changes in orthopaedic and trauma surgery, but whether they are also advances is not known. Like every other clinical specialty this one desperately lacks the tools, the will, and the resources to assess whether each change is an advance or merely another passing fashion.

In this article I will review the major changes which have taken place in musculoskeletal surgery and point out where they most urgently need assessing.

Trauma surgery

Trauma surgery continues to dominate the workload of most orthopaedic surgeons, encroaching on resources needed for elective surgery. Fractured neck of femur remains the bread and butter of trauma. The numbers continue to rise,[1] but the average length of stay in many units has fallen.[2] This is possibly through increased liaison between geriatricians, orthopaedic surgeons, and the community, but it may also reflect the fairly new attitude that acute hospital beds are an expensive resource and that there is no worse place for an elderly patient than in bed in hospital.[3] Patients may be moving from acute beds more rapidly, but perhaps they are simply transferring to non-acute beds, where they may actually stay much longer.[4] The faster turnover of acute trauma beds may not be serving patients or even the health service as well as it might first seem. There is a great need for a large multicentre study to look at (*a*) whether early surgery improves the long term outcome, (*b*) the effect of the type of fixation used and the experience of the operator (most of these operations are performed by junior surgeons), and (*c*) the cost-benefit of rehabilitation performed in an acute hospital, in a rehabilitation unit, or at home.

Training

The management of major trauma at its earliest stages has changed beyond recognition with the introduction of proper training. The advanced trauma life support course lasts for three days and teaches the management of severely injured patients.[5] It is highly didactic and based on practice in the United States, but it uses a wide range of modern teaching techniques and provides proper training in educational techniques for the instructors. It has now spawned a series of similar courses on medical and paediatric emergencies and for ambulance crews working at the roadside.

The result has been extraordinary. In units with trained staff severely injured patients are rapidly resuscitated, given a diagnosis, and passed on to definitive management by a team of staff working fast but quietly. Gone are the furious arguments over priorities between specialties, when the management of the patient was delayed and even misdirected.

There is, however, a real need to demonstrate the value of this form of training. Many of the units trained in advanced trauma life support techniques contribute to an international database, the multiple trauma outcome score, which contains data on the severity of injury and outcome in terms of survival of over 100 000 severely injured patients.[6] Taking part in the scheme strengthens the database and allows each unit to measure its success in resuscitating patients against all the other units taking part in the study. The weakness of the system is that it preaches to the converted: units that have not adapted to the modern method of resuscitation do not send data to the scheme. If all units had to submit data to the multiple trauma outcome score the value of training in advanced trauma life support score and even other systems could be evaluated. As it stands, however, the score loses much of its value, and one of the major revolutions in medical training remains open to question.

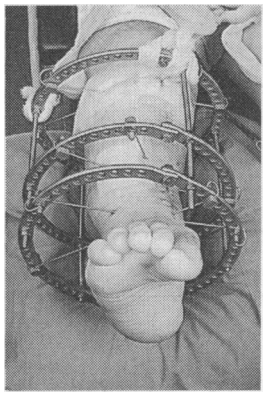
Stabilisation of fractures

Leading on from the philosophy of the advanced trauma life support score, and also an important change from the United States, is the concept that patients with major and multiple trauma should have definitive stabilisation of all fractures as soon as they leave the resuscitation room. This contradicts conventional teaching based on experience in the first and second world wars, which found that surgery should be delayed until the patient's condition was physiologically stable. The only controlled trials showing the value of early aggressive intervention in multiple trauma have been performed in the United States in units deeply committed on philosophical and financial grounds to early surgical intervention.[7] The main outcome measure used has been the adult respiratory distress syndrome, a rare but easily measured complication that probably contributes little to the overall morbidity or mortality of the bulk of patients with trauma in Britain. Nevertheless, these studies claim that early fixation of fractures reduces mortality, morbidity, and length of stay in people of working age, many of whom should be able to return to productive work rather than being invalids for life.

The resource and social implications of this model of trauma care are currently the source of hot debate, as it means transferring all patients with major trauma from district general hospitals to specialist centres with the resources and skills to allow theatres and teams of trained trauma surgeons to be available at a moment's notice, day or night. Such a policy would have a profound effect on the viability of accident and

Nuffield Department of Orthopaedic Surgery, University of Oxford, John Radcliffe Hospital, Oxford OX3 9DU
Christopher J K Bulstrode, *consultant in trauma and orthopaedic surgery*

BMJ 1995;310:917-9



External fixator used for treating complex fractures and for leg lengthening

emergency departments and even of some of the smaller district general hospitals. Britain is one of the few countries where it might be possible to compare early aggressive management of trauma with stabilisation followed by definitive fixation of fractures at a planned fully staffed daytime operating list in an unbiased randomised controlled trial. The answer would have planning implications reaching far beyond the provision of trauma services.

Collaboration

In major trauma plastic surgeons and orthopaedic surgeons increasingly collaborate with each other. Bones cannot heal, however well fixed, if they remain exposed to the outside world after an open fracture. The participation of plastic surgeons at the first emergency operation allows non-viable soft tissue to be excised and flaps to be rotated over bare bones to provide a blood supply and protection from infection.

Although the value of collaboration with plastic surgeons at an early stage is clear, the downside is that the skills required for this type of work require two surgical teams (plastic and orthopaedic) and operating theatres available for six hours or more at a moment's notice. This development can proceed only if trauma is concentrated in comparatively few centres —a decision that can be made only nationally or regionally.

External fixation of fractures

New techniques in treating fractures or osteotomies (fractures created deliberately by a surgeon) with adjustable external fixators are found at the interface between trauma and elective orthopaedic surgery. A fundamental principle of fracture treatment used to be that fractured bones should never be held apart if healing was to take place. Techniques pioneered by Ilizarov (a Russian orthopaedic surgeon working in Siberia) have turned this concept on its head and led to a proliferation of techniques for dealing with the complications of fractures and short limbs. If the two ends of a fracture are drawn apart by fractions of a millimetre each day after an initial period of close apposition, a fracture can be stretched to lengthen a limb.[8]

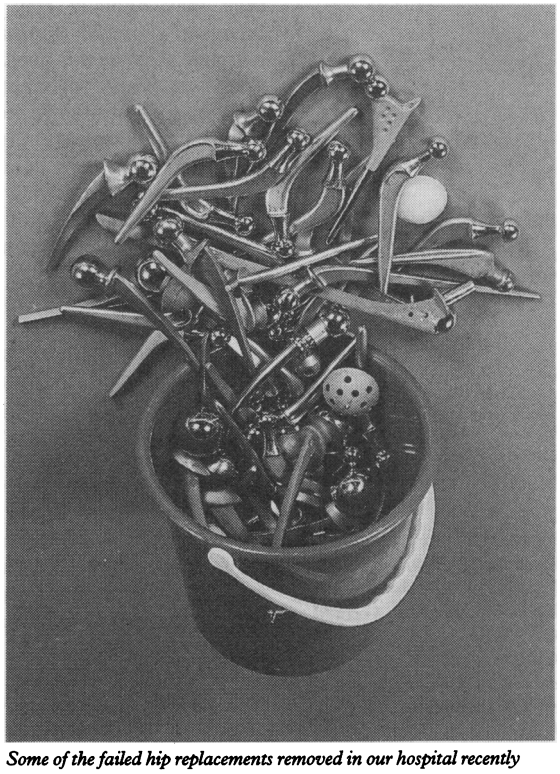
This technique can be used to lengthen both limbs by several centimetres in some forms of dwarfism, as well as to correct the length of a limb when a part of the bone has been lost as a result of trauma or exised to eradicate bone infection. The problem is that the technique is immensely time consuming: the lengthening process often takes more than a year to perform and the new bone needs to be protected for a long time until it reaches full strength. The technique may fail at any time, in which case the limb may have to be amputated. Clearly, the technique should be used only with extreme caution when used only for cosmesis. Even after trauma the physical and psychological consequences of failure must be borne in mind before embarking on what is an enormous undertaking for both surgeon and patient.

Joint replacement

In elective orthopaedic surgery there have also been major changes. Joint replacement continues to increase its dominance of the workload. Hip replacement is now a routine, well proved, and highly successful operation —or is it? Total hip replacements have become a veritable playground for manufacturers looking for new modifications to justify the continuation of research and development and marketing departments and to add value to a product. In the final analysis the cost of all these new developments is borne by the NHS. This would be perfectly reasonable if these developments led to better, longer lasting joints. Unfortunately, so far the cheapest (and most old fashioned) three designs of hip replacements seem to give much better long term results than the other 55 newer and much more expensive designs available.

Currently new designs can be brought on to the market without any form of clinical testing. It will be nothing short of a tragedy if the new European Union harmonisation of standards for implant, which starts this year, does not address this issue. The situation in other European countries is, if anything, worse than in Britain. Here is an opportunity to introduce sensible measures to ensure that only implants that are shown to be safe in patients are generally available. Surgery lags far behind medicine (with its controls of the pharmaceutical industry) in this respect.[9]

Knee replacements are now rapidly following hip replacements in their proved long term value[10] and in the proliferation of expensive new designs with no rigorously demonstrable advantages over the older cheaper types. What has become disturbing is the ignorance of patients, general practitioners, and even some orthopaedic surgeons about the reliability of the operation. As a result there is an enormous back log of cases of arthritis suitable for knee replacement, estimated by one study to be as many as a million patients.[11] This suggests a major commitment when currently only about 20 000 knee replacements are thought to be performed annually. It would be invidious to suggest that the Department of Health has avoided informing anyone of the value of total knee replacement because of the resources which would be required to supply the demand. Nevertheless, if ignorance has been used unconsciously and unperceived as a technique for rationing, this smacks of incompetence rather than wisdom. Both hip and knee replacements are useful and reliable operations that should be widely available. They also should not have to compete, as they do now, with the increasing numbers of fractured necks of femur for operating time. Because so many patients will need joint replacements it would be a sound investment to ensure that only reliable implants are used and to determine which



Some of the failed hip replacements removed in our hospital recently

Recent advances in trauma and orthopaedics

- Increasing numbers of fractures of the neck of the femur is putting great pressure on all resources
- Didactic, structured training in advanced trauma life support is transforming the management of severely injured patients
- Fractures need early stabilisation and a team approach to their management, which means that trauma expertise needs to be concentrated in large centres
- Limb lengthening is now relatively straight forward but time consuming and expensive. The consequences of failure are dire. Its role in trauma and orthopaedics has not yet been clearly defined
- Total hip and knee replacements are now well proved and in common use, but many of the public and even general practitioners seem unaware of this. The number of new unproved joint replacement designs coming on to the market is burgeoning and regulation is needed
- Magnetic resonance imaging is now cheaper, safer, and more reliable in diagnosing problems in the knee joint and should replace diagnostic arthroscopy
- Young athletes often damage the anterior cruciate ligament, but surgery is not always needed. Artificial ligaments seem to fail in the long term
- Dynamic ultrasound examination offers a safe non-invasive test for congenital dislocation of the hip. It seems to be reliable in diagnosing unstable hips and should allow the early identification of hips at risk at a time when non-operative treatment will be effective
- The risk of death from pulmonary embolus after total hip replacement has been overestimated and anticoagulants should not be used routinely

factors are responsible for the increasing number of failed joint replacements; replacing failed joints may in the future take up to 30% of all the resources currently available for joint replacement.[12]

Investigation of joints

The vogue for investigating all young patients with knee pain by arthroscopy is now being replaced with a much more selective policy since magnetic resonance imaging was shown to be at least as reliable as arthroscopy in diagnosing torn menisci.[13] It is also cheaper and less invasive. Luckily the fashion for replacing torn anterior cruciate ligaments, which has dominated orthopaedic practice in the United States and Australia, has been kept in perspective in the United Kingdom.[14] Not all patients with torn anterior cruciate ligaments seem to need an operation. This is, firstly, because some may obtain reasonable function without surgery and, secondly, because in the long term most of the substitutes for the anterior cruciate ligament seem to become stretched or to fail. A properly conducted randomised controlled trial of large numbers of patients followed up over a long time is needed to answer the question of whether the torn anterior cruciate ligament needs replacing and if so how.

The diagnosis of congenital dislocation of the hip is becoming easier with the use of ultrasonography. In the right hands, a dynamic examination of the hip by ultrasonography seems to provide far more information than *x* ray films ever could (and without any radiation risk). Provided that all neonates in whom there is any suspicion of a problem are referred for proper investigation, the long term problems of a missed congenital dislocated hip should become a thing of the past.[15]

Prophylactic anticoagulant treatment

For some years manufacturers of anticoagulants and research workers in deep vein thrombosis have tried to persuade surgeons that all patients undergoing major surgery should receive prophylactic anticoagulation.[16] They have argued that death from pulmonary embolus is a common and avoidable cause of death after major elective surgery and that the complications of anticoagulation are both rare and of no significance. Many orthopaedic surgeons have been puzzled by the high death rates from pulmonary embolus after surgery quoted by the proponents of anticoagulation. They have also been concerned by their own experience of prophylactic anticoagulation, which can produce excessive bleeding, haematoma formation, secondary infection, and complete failure of the joint replacement.

A series of studies in total hip replacement of tens of thousands of patients in all[17-19] have shown that the overall death rate in unprotected patients is an order of magnitude lower than that commonly quoted by those with a vested interest in claiming that it is a significant problem. In fact it is so low that it is not possible to show a clear relation between death from pulmonary embolus (low in elective orthopaedic surgery) and rate of deep vein thrombosis (high in elective orthopaedic surgery). Furthermore, the complication rate may not be as low as previously published. Any future study looking at this problem will have to take as careful account of the risks as of the benefits of anticoagulation.[20])

I wonder whether orthopaedics is unique in its findings. Certainly there are plenty of funds available for showing that anticoagulation of one sort or other reduces rates of deep vein thrombosis. But when it comes to funding the large trials needed to show the cost-benefit of anticoagulation, with overall death rate as the main outcome measure, the paucity of published trials speaks for itself. If future changes in orthopaedic practice are to be advances, and not simply temporary trends dictated by fashion, a fundamental change in attitude to evidence based medicine is required both in orthopaedics and in other specialties.

1 Nilsson R, Lofman O, Berglund K. Increased hip-fracture incidence in the county of Ostergotland, Sweden, 1940-86, with forecasts up to the year 2000: an epidemiological study. *Int J Epidemiol* 1991;20:1018-24.
2 Gustafson Y, Brannstrom B, Berggren D. A geriatric-anesthesiologic program to reduce acute confusional state in the elderly patients treated for femoral neck fractures. *J Am Geriatr Soc* 1991;39:655-62.
3 Cameron ID, Lyle DM, Quine S. Accelerated rehabilitation after proximal femoral fracture: a randomised controlled trial. *Disabil Rehabil* 1993;15: 29-34.
4 Kennie D. Perioperative care: the funnel of rehabilitation. In: Rowley D, Clift B, eds. *Skeletal trauma in old age*. London: Chapman and Hall, 1994:27-44.
5 Skinner DV. Advanced trauma life support. *Injury* 1993;24:147-8.
6 Champion HR, Copes WS, Sacco WJ, Lanwick MM, Keast SL, Bain LW Jr, *et al.* The major trauma outcome study: establishing national norms for trauma care. *J Trauma* 1990;30:1356-65.
7 Bone LB, Johnson KD, Weigel J, Scheinberg J. Early versus delayed stabilisation of femoral fractures. *J Bone Joint Surg Am* 1989;71:336-40.
8 Paley D. Current methods of limb lengthening. *J Pediatr Orthop* 1988;8:73-92.
9 Bulstrode CJK, Murray DM, Carr AR, Pynsent P, Carter SR. Designer hips. *BMJ* 1993;306:732-3.
10 Vince KG, Insall JN, Kelly MA. The total condylar prosthesis. 10-12 year results of the cemented knee replacement. *J Bone Joint Surg Br* 1989;71: 793-7.
11 Tennant A, Hillman M, Chamberlain MA, Fear J, Pickering A. Estimating the number of people who need knee arthroplasty. British Orthopaedic Association meeting, Nottingham, autumn 1994.
12 Bulstrode CJK. Keeping up with orthopaedic epidemics. *BMJ* 1987;295:514.
13 Spiers ASD, Meagher T, Ostlere SJ, Wilson DJ, Dodd CAF. Can MRI affect arthroscopic practice? *J Bone Joint Surg Br* 1993;75:49-52.
14 Dandy DJ. Some clinical aspects of reconstruction for anterior cruciate ligament deficiency. British Orthopaedic Asociation meeting, Nottingham, autumn 1994.
15 Boeree NR, Clarke NMP. Ultrasound imaging and secondary screening for congenital dislocation of the hip. *J Bone Joint Surg Br* 1994;76:525-33.
16 Thromboembolic Risk Factors (THRIFT) Consensus Group. Risk of and prophylaxis for venous thromboembolism in hospital patients. *BMJ* 1992;305:567-73.
17 Collins R, Scrimgeour A, Yusuf S, Peto R. Reduction in fatal pulmonary embolism and venous thrombosis by perioperative administration of subcutaneous heparin. *N Engl J Med* 1988;318:1162-73.
18 Seagroatt V, Tan HS, Goldacre M, Bulstrode CJK, Nugent I. Elective total hip replacement: incidence, emergency readmission rate, and postoperative mortality. *BMJ* 1991;303:1431-5.
19 Owen TD, Moran CG, Smith SR, Pinder IM. Results of uncemented porous-coated anatomical total hip replacement. *J Bone Joint Surg Br* 1994;76: 258-62.
20 Murray DW, Carr AJ, Bulstrode CJK. The case for pharmacological thromboprophylaxis for total hip replacements. *J Bone Joint Surg Br* (in press).