



Audit

Utilisation of shoulder arthroplasty in the UK

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Aims: To estimate the *per capita* utilisation of shoulder prostheses in the UK and to compare UK figures to those from the US.

Methods: A postal and telephone survey was undertaken of all hospitals in the UK carrying out orthopaedic operations. The relative usage of total shoulder replacement and hemi-arthroplasty for both elective and trauma indications were analysed and UK figures compared to those from the US.

Results: There were 281 replies from 314 questionnaires, a response rate of 90%. The *per capita* rate of shoulder replacement is approximately one-tenth for total replacement and one-fifth for hemi-arthroplasty compared to the US, suggesting that there is an unmet demand in the UK. In the US, the proportion of total replacements to hemi-arthroplasties for elective indications is approximately equal whereas in the UK there are twice as many hemi-arthroplasties, which raises the question as to whether hemi-arthroplasties are being used when a total replacement might be preferable. The numbers of shoulder arthroplasties implanted by individual surgeons and units is, except for a few large centres, small. Consequently, it is much more difficult for the surgeon to evaluate the various prosthetic designs and surgical techniques.

Conclusion: There is a need for a national register to increase the knowledge about such designs and techniques and to analyse risk factors.

Key words: Shoulder replacement – Indications – Prosthesis

There is currently little information available regarding the utilisation of shoulder prostheses in the UK. This is in contrast to the wealth of information for shoulder prostheses in the US,^{1,2} and the information available in the UK and US on total knee (TKR) and total hip replacement (THR).³⁻⁷

Epidemiological studies have documented wide-spread and persistent variations in the indications for surgical procedures.⁸ In orthopaedic practice, there is variation in the indications for several types of operative intervention, including total hip and total knee arthroplasty.^{4-6,9-11} It is commonly believed that professional uncertainty is an important factor in the variability. This uncertainty is largely based on the lack of evidence-based medicine

concerning the so-called 'appropriateness' of alternative forms of treatment for the same clinical condition. Wennberg *et al.*⁸ reported a high variation in the rates of total hip arthroplasty and other major elective procedures on the hip, but a low variation for repair of fractures around the hip for which treatment regimens have been agreed. A similar uncertainty exists regarding the utilisation of humeral head replacement (HHR) and total shoulder replacement (TSR) for elective and traumatic conditions.²

The purpose of this study was to estimate the *per capita* utilisation of shoulder prostheses in the UK. This was compared to the figures available from the US, as there is a tendency to follow the pattern of surgery carried out in

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the US at a time interval in the UK, which we have seen for total hip and total knee replacements. In addition, the relative usage of HHR compared to TSR was determined, and the frequency with which each was performed in any one unit. For HHR, we tried to estimate the proportion inserted for fractures compared to elective indications. Finally, we were

Table 1 The utilisation of total shoulder replacements

Prostheses per year (<i>n</i>)	Hospitals (<i>n</i>)	Mean no. of implants	Centres performing shoulder surgery (%)
0	113	0	48.92
1-5	76	2.73	32.90
6-9	26	7.00	11.26
10-19	11	12.55	4.76
> 20	5	23.2	2.16

Table 2 Humeral head replacements implanted for trauma indications

Prostheses per year (<i>n</i>)	Hospitals (<i>n</i>)	Mean no. of implants	Centres performing shoulder surgery (%)
0	92	0	39.83
1-5	117	2.48	50.65
6-9	11	6.91	4.76
10-14	10	10.20	4.33
15-19	1	15.00	0.43
> 20	0	0	0

Table 3 Humeral head replacements implanted for elective surgery

Prostheses per year (<i>n</i>)	Hospitals (<i>n</i>)	Mean no. of implants	Centres performing shoulder surgery (%)
0	64	0	27.71
1-5	110	3.05	47.61
6-9	23	7.22	9.96
10-14	22	10.68	9.52
15-19	6	15.33	2.60
> 20	6	28.17	2.60

Table 4 Comparison of the number of hospitals performing both elective and trauma hemi-arthroplasties

Elected HHRs inserted per year (<i>n</i>)	HHRs inserted for trauma per year (<i>n</i>)					
	0	1-5	6-9	10-14	15-19	> 20
0	18	41	3	2	0	0
1-5	45	58	6	3	0	0
6-9	12	0	1	1	0	0
10-14	11	6	1	2	1	0
15-19	3	2	0	1	0	0
> 20	3	2	0	1	0	0

interested to ascertain the variety of shoulder prostheses used in the UK. Using these figures, we have estimated the potential use of shoulder replacements and comment on the implications for the provision of the service.

Patients and Methods

A list of all hospitals in the UK performing orthopaedic procedures, excluding children's hospitals, was obtained from the British Orthopaedic Association. There were a total of 314. A postal questionnaire was sent, addressed to the senior nurse in charge of the orthopaedic theatre, and supplemented by a telephone survey.

The questionnaire asked if the unit performed any shoulder replacements. If the answer was yes, they were asked, for the period 1 April 1998 to 31 March 1999, how many TSRs and HHRs were used in elective operations and how many HHRs were inserted for trauma. Information about the types of prostheses used was requested.

Results

The postal questionnaire returned 149 replies from a total of 314 giving an initial response rate of 48%. The telephone survey to non-responders increased the response rate to 90% (281 hospitals). Overall, 231 hospitals (83%) had inserted shoulder prostheses; 64 of the 231 (28%) had done only HHR for trauma and had not used shoulder prostheses for elective indications. Conversely, 92 hospitals (40%) had used them solely for elective indications.

Of the 231 hospitals, 118 (51%) had used TSRs. There were a total of 657 TSRs recorded in this survey; this is 31% of the total number of shoulder prostheses and 40% of those used for elective indications. The numbers of TSRs done in each unit in the study period is shown in Table 1. Only 42 hospitals performed more than 5.

There were a total of 1485 HHRs accounting for 69% of all shoulder prostheses. Of these, 482 were used for trauma and 1003 for elective indications; this is 23% and 47%, respectively, of all the shoulder prostheses in this study. Twenty-two hospitals inserted more than 5 HHRs for trauma in the

Table 5 Prostheses inserted

Prosthesis	Total (<i>n</i>)	Total (%)
Neer (I + II)	437	21.68
Biomet	415	20.59
Global	377	18.70
3M	199	9.87
Nottingham	153	7.59
Copeland	131	6.50
Tournier aequalis	103	5.11
Sulzer-select	109	5.41
Osteonics	30	1.49

Table 6 Rates per 100,000 of population for specific arthroplasties in the UK and US per year

Implant	UK	US
Total hip replacement	68.03	50.24
Total knee replacement	58.97	89.84
Total shoulder replacement	1.12	11.41
Humeral head replacement	2.53	10.14

recorded year (Table 2), and only 57 hospitals inserted more than 5 for elective purposes in the same period (Table 3). There appears to be little correlation between the hospitals which insert large numbers of prostheses for trauma and for elective indications (Table 4).

Table 5 lists the most commonly used implants in each hospital. Table 6 shows a comparison between the rate per 100,000 population for total hip, knee and shoulder replacements in the UK and US.

Discussion

There are limitations to this study and the accuracy of the data may be questioned. It is retrospective which is inevitably much less accurate than a prospective collection. However, most hospitals keep an accurate record in the operating theatre of the implants inserted; this record tends to be much better than the overall record of operations performed and is more easily accessed. Furthermore, because the numbers of shoulder replacements is small compared to hip and knee replacements, it is quicker to identify and count them; this increases compliance with this type of survey. We are reasonably confident, therefore, that the overall numbers for TSRs and HHRs done in the responding hospitals are accurate. We can be less confident about the quality of the data for the differentiation between elective and traumatic indications, but most hospitals now identify trauma cases separately from elective ones. The most accurate data were obtained from hospitals which use a computer-based theatre register allowing easy data retrieval and those that kept an implant register. In addition, by following up the postal survey with personal telephone conversations with the relevant person in the operating theatre, it was possible to achieve a high response rate and discuss the accuracy of the data. Although a 90% return rate for this type of survey is high, it does matter if, within the 10% of non-responders, there is a unit which is known to do a large number of shoulder replacements. One such unit, which performs about 80 shoulder replacements per year, declined to co-operate with the study; the other units failing to respond were all ones in which a similar number of shoulder replacements to the average in this survey would be expected. If one adds 10% to the overall figure and a further 80 to account for the large unit, the estimated total number of shoulder replacements in the

UK from this survey would be 2400–2500, which is similar to the figure quoted in a recent publication by Mackay *et al.*,^{12, 16} but still one order of magnitude less than the *per capita* rate in the US. Furthermore, in that paper the authors gave estimates for the market share of each of the prostheses and our results produce broadly similar proportions. Therefore, despite the limitations, this study has obtained some useful data.

Studies of variation in rates of specific operative procedures have demonstrated less difference where surgeons have agreed on the indication for the procedure.¹³ Wennberg *et al.*⁸ reported a high variation in the rates of total hip arthroplasty but a low variation for the rates of operation for fractures of the neck of the femur. There is reasonable agreement that HHR is used to treat fractures of the proximal part of the humerus that are not amenable to primary internal fixation and to treat arthritis of the glenohumeral joint. Currently, there is a debate regarding the relative indications for HHR as against TSR¹ for the treatment of arthritic conditions of the glenohumeral joint. Vitale *et al.*,² from the US, stated that the rates of HHR for fracture and for arthritis were roughly similar. In comparison, this study shows that in the UK there are proportionately twice as many HHR for elective indications (1003 per year) as compared to traumatic ones (482 per year). This may be because relatively fewer fractures are treated by HHR, an explanation that could be supported by papers reporting indifferent results of HHR for fractures of the proximal humerus.¹⁴ The alternative explanation is that a higher proportion of HHR replacements are done for elective indications as compared to TSR. This raises the question as to whether the decision to do a HHR as opposed to TSR reflects the technically demanding nature of glenoid replacement, and also the high incidence of loosening around the glenoid component.¹⁵ The Swedish Shoulder Arthroplasty Register also notes a higher percentage of HHR performed (87%) as compared to TSR (13%). This study would support that view in that the number of TSRs (657) implanted was 40% of the total number of prostheses implanted electively. Studies are now being published reporting that TSR gives a better result than HHR for non-traumatic indications,¹ but the majority of these studies are of short duration only.

Our study indicates that the numbers of HHRs and TSRs done by most centres are small. More than three-quarters do 5 or less per year. Even if all these are done by one surgeon in such a centre, which is obviously desirable for expertise to be gained, it is inevitable that individual surgeon experience will be limited. Whilst there is no good evidence that volume is directly related to outcome, common-sense would dictate that when the frequency with which a surgeon performs a particular procedure falls to a very low level, there may be some compromise. This study does not address that issue and is not intended to

suggest a required minimum number. When small numbers of technically difficult operations are performed in centres, lessons learned and complications observed may not be shared with other similar centres.

This current situation may well change in the foreseeable future as the numbers of procedures performed will increase and experience gained. A decade ago, less hip replacements per head of population were implanted in the UK compared to the US and now the rates are approximately equal or even greater in the UK. A similar trend is noted for knee replacement, although the UK rate still lags behind the one for the US by 30%. If the same pattern is followed for shoulder replacement, it is to be expected that there will be a substantial increase in the numbers over the next decade. Our study suggests that the UK *per capita* rate of implantation for TSR is 10 times and for HHR 5 times less than in the US. That has obvious implications for the organisation and cost of providing such a service.

In an era when evidence-based medicine is increasingly high on the agenda, it is important to have accurate data and there is a very good case to be made for a national register of shoulder implants just as the case for a national hip register has been made.^{16,17} This is particularly important when the use of an implant is increasing and there are an increasing variety of prostheses on the market, most of which have only short-term clinical reviews. Mackay *et al.*¹² highlighted this point in relation to shoulder prostheses; they noted that in the UK in 2001 there were 20 shoulder implant systems, with 14 introduced since 1990 and 4 in the previous 5 years, of which many had been recently modified. The Swedish Shoulder Arthroplasty Register¹⁸ has highlighted the difficulties in starting a national register, and the number of new concepts that have become available on the market. It is important to have such a register so that unsafe implants and complication can be quickly detected. A register should also collect data regarding secondary procedures, not only revision arthroplasty, so we can distinguish between secondary problems, such as acromioclavicular joint pain or impingement and implant failure. This should help us to know what to expect in the total population, in terms of survival rate of the implants, and the forthcoming incidence of some conditions needing subsequent surgery. The principal problem when starting a national register is getting all centres to agree on what to register and then to participate.

Conclusions

This study suggests that in the next few years there will be a substantial increase in the numbers of shoulder prostheses inserted in the UK and there is likely to be a trend towards an increasing proportion of total shoulder replacements relative to humeral head replacement. This has implications for the organisation and cost of providing such a service. Currently,

there is insufficient information about the numbers and types of implants being performed and there are many centres doing small numbers of shoulder arthroplasties. In order to get good data about outcome, it is recommended that a national register for shoulder arthroplasty is established as has now been agreed for total hip arthroplasty.

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