Hip Replacement, Changes In Trends: Are We Changing Our Practice For The Right Reasons?

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Citation

C Mauffrey, A Prasthofer. *Hip Replacement, Changes In Trends: Are We Changing Our Practice For The Right Reasons?*. The Internet Journal of Orthopedic Surgery. 2005 Volume 3 Number 2.

Abstract

Hip replacement is probably one of the most revolutionary advances in modern orthopaedic surgery. It is a procedure that has had an extraordinary evolution since John Charnley more then 40 years ago. In this article we review the literature with regards to the recent evolution of hip replacement surgery with regards to the pre operative care, the surgical innovations, and the post operative care. We discuss whether our practice is changing for the right reasons.

INTRODUCTION

Hip replacement is probably one of the most revolutionary advances in modern orthopaedic surgery. It is a procedure that has had an extraordinary evolution since John Charnley more then 40 years ago. In 2000, approximately 152000 patients received a total hip replacement in the US [1] and with an ageing population, this number is expected to rise rapidly in the western world. Aware of this very lucrative business, the industry has spent millions of pounds in the development of new prosthesis and bearing surfaces. The flourishing of the number of prosthesis available has rendered the creation of national registries a necessity. First set-up in Sweden, these national joint registries have rendered the follow-up of patients, prosthesis, the surgical technique and the outcome of the operation easier to analyse and have benefited patients, physicians and the industries. Hip replacement surgery goes far beyond the surgical procedure itself and there has been significant advances in the preoperative management of patients (such as the indications for hip replacement and the choice of prosthesis) and in their post operative care (such as DVT prophylaxis and rehabilitation).

In this article we review the literature with regards to the recent evolution of hip replacement surgery with regards to the pre operative care, the surgical innovations, and the post operative care. We discuss whether our practice is changing for the right reasons.

PRE-OPERATIVE PLANNING

INDICATIONS

In recent years surgery has gone from a surgeon-based decision-making to a patient-based decision-making and this applies to any type of non-emergency surgery. With the increasing availability of information on the internet, patients are more aware of the surgery that has been offered to them, the indications of the surgery and the risks involved and can make their own informed decision. For this reason a well defined treatment algorithm must be available at least for the most common surgical procedures. With regards to the treatment decision algorithm for degenerative hip disease, there are considerable differences in different European countries and a more uniform approach needs to be implemented taking into account co-morbidity, occupational and leisure activities, social backgrounds as well as organ-specific date [2] . In fact, the incidence of joint replacement procedures has increased at a faster rate than can be ascribed solely to the effects of population increase and population ageing [3] . In 2000, approximately 152000 patients received a total hip replacement in the US [4] , with the main indication being osteoarthritis. With a significant improvement in the technology surrounding this common orthopaedic procedure, the mortality and morbidity of patients has significantly decreased leading to a broadening of the indications for total hip replacement.

Severe pain and disability usually accompanying radiological changes at the hip are generally though to be the indications for the operation, in patients where non-operative treatment has failed or is futile [5] .

Rheumatoid arthritis and osteoarthritis are the two main responsible in the aetiology of degenerative hip disease. The

prevalence of these conditions is thought to be around 0.5 and 1.5% respectively, in England and Wales.

WHAT PROSTHESIS

CEMENTED VS UNCEMENTED

Recent advances in both femoral cementing techniques and the design of the cemented stems have resulted in near perfect survivorship (>90% at 25 years). The results for non cemented femoral component are very similar. When the survivorship of the cemented acetabular component is compared to the uncemented acetabular component it becomes evident that cementless techniques are the preferred method for the vast majority of acetabular reconstruction [6]. Surface finish of cemented hips seems to be a critical factor in the durability of fixation with cements. In fact, Callagher et al reviewed the 10 years results of 574 hips using stems with three different surface finishes (5, 30 and 80 Ra). The rate of revision was significantly higher in the 5 Ra then in the 80 Ra and in the 30 Ra then in the 80 Ra. In younger active patients the trend to use uncemented technique for the femoral stem is well established and allows easier revision if the prosthesis was to fail [7]. With regards to the cementless technique some authors have studied the shear strength and energy to failure of cementless hip. It seems that adding growth factors to the porous coating significantly increases the shear strength and energy to failure.

BEARING SURFACE

Currently, the most frequently used bearing surface is polyethylene. The joint is put through millions of cycles over their lifetime and consequently wears. The result is aseptic loosening which accounts for 60 to 70% of revision surgery [8]. Consumption of the wear particles by macrophages leads to an inflammatory cascade that leads to resorption of bone surrounding the prosthesis ultimately increasing the loosening. This concern has led to the emergence of alternative bearing surfaces such as metal on cross-link polyethylene, metal on metal, and ceramic bearing surfaces. The most frequently used bearing surface in North America is now cross-linked polyethylene, in fact out of all the standard polyethylene, it has demonstrated to have the highest resistance to wear in hip replacements [9].

TYPE OF PROSTHESIS

Despite the recent advances in technology surrounding hip replacement there has been very few randomized control trial comparing different types of prosthesis. In fact, in recent years the numbers of hip prosthesis available has flourished making it very difficult for one surgeon or institution to choose from. While such market competition may foster innovation, it also creates a dilemma that is central to outcomes analysis: the frequent modification of implant design outpaces our ability to measure the in vivo mechanical and clinical effectiveness of each change. Furthermore the prices of these prosthesis ranges from about 300 pounds to over a 1000 pounds. The main question is whether this range of prices can be related and justified by the outcome measures such as failure rates and survival of the prosthesis. In 1998, et al reviewed the literature noting the scarcity of RCT comparing different types of prosthesis. Their meta-analysis was based on comparative observational studies, such as the Swedish National registry, the Norwegian national registry and several other studies from the literature. The Charnley prosthesis which has been available for the longest period and has the longest follow up has been shown to be one of the most successful with regards to its survival. In fact, data from the Swedish registry have noted that the three most successful prosthesis were the Charnley, Lubinus IP and CAD with no significant difference at 15 years between them. One thing that needs to be added though in these long term follow up studies is that a bias might be introduced in the observation of the performance of the Charnley prosthesis over the years, in fact the design of this prosthesis has changed over the years of its use. From the meta-analysis, the Exeter appeared to have a relatively favourable revision rate. At the other extreme some prosthesis such as the Christiansen fell out of use due to high revision rates.

In recent years, there has been a re-emergence of resurfacing hip arthroplasty. This procedure is indicated for younger patients with degenerative hip joint diseases, when conservative measures have failed. In considering hip resurfacing arthroplasty, it is recommended that surgeons take into account activity levels of potential recipients and bear in mind that the current evidence for the clinical and cost effectiveness of MoM hip resurfacing arthroplasty is principally in individuals less than 65 years of age (NICE). Current resurfacing techniques use metal on metal components (cobalt-chromium-molybdenum alloy) and involve minimal bone resection. Proponents suggest that the procedure will restore normal anatomy, maximise proprioception, minimize dislocation rates, and will be amenable to future revision should it fail in the future. Recently, Treacy et al [10] reported on the survival at five years of 144 consecutive metal-on-metal resurfacings of the hip implanted between August 1997 and May 1998. The survival at the end of five years was 98% overall and 99%

for aseptic revisions only. The mean age of the patients at implantation was 52.1 years.

Curtin et al [11] assessed the current practice of 111 Orthopaedic consultants in Ireland with regards to implant type, surgical approach, technique, and indications. The cemented Charnley low friction arthroplasty remains the most popular choice in low demand patients over the age of 60. 83% of respondents used cemented (with contemporary cementing technique for 95% of cases) implants, predominantly Charnley THR (59%) in elderly patients. 16% used hybrid or uncemented implants in elderly patients. In younger active patients, 70% of consultants have changed their practice and put in a different THR. Marginally more consultants employ hybrid then cemented techniques and the routine use of uncemented THR and hip resurfacing is prominent, and many of these use better bearing surfaces such as metal on metal or ceramic on ceramic.

THE SURGERY

MINI-INVASIVE SURGERY

Minimally invasive surgery represents one of the most recent techniques to have appeared within hip arthroplasty. In fact, the incision of most surgical approaches measures about 20 to 30cm. Proponents of minimally invasive surgery have reported a number of advantages with such technique, including reduced early postoperative pain, reduced length of hospital stay and rehabilitation, earlier return to work, decreased blood loss, improved cosmetic appearance and high patient satisfaction. Other studies have failed to confirm improved outcomes. Opponents to the mini invasive approach have highlighted the fact that because of a restricted visual field, it is more technically difficult to achieve an optimal prosthesis placement. Furthermore damage to vasculo-nervous structure, to prosthetic surface during implantation and longer operative times are all risks that have been highlighted and that need further investigation with randomized control trials.

In a recent review (January 2006) [12] the National Institute for Health and Clinical Excellence conclude that the current evidence on the safety and efficacy of single mini-incision hip replacement appears adequate to support the use of this procedure. The benefits of a single incision include less tissue trauma, less blood loss and less pain in appropriately selected patients and in the hands of adequately trained surgeons.

COMPUTER ASSISTED SURGERY

In arthroplasty, the use of computer assisted surgery is to optimize the placement of the prosthesis and therefore achieve a finest limb alignment in fact alignment errors are associated with more rapid implant failure and less satisfactory functional results.

In a recent study, Honl et al [13] prospectively compared the use of a robot-assisted THR implantation with manual surgical technique on 154 patients. The follow up was 24 months. The group of patient with robot assisted implanted device showed longer operative times ($p<0.001$) and more dislocations ($p<0.001$), however they had better limb length equalisation ($p<0.001$) and stem orientation ($p<0.001$). The revision rate in this group was 15%.

Although the results are promising the utility of robot assisted surgery will remain uncertain until long term follow up will be made available in the literature.

POST-OPERATIVE MANAGEMENT

DVT PROPHYLAXIS

The most striking fact with regards to prophylaxis of DVT following hip arthroplasty is the heterogeneity of the practice amongst different units and consultants. The options such as compressive stockings, foot pumps, low molecular weight heparin, warfarin, and aspirin are numerous. In fact, many reviews, guidelines, and meta-analysis for thromboprophylaxis in high risk groups are available. A UK National institute for health and clinical excellence clinical guideline on the prevention of venous thromboembolism in patient undergoing orthopaedic surgery is due to be published by May 2007. The most recent guidelines are from the Scottish Intercollegiate Guidelines Network (SIGN) in 2002. It is now well known from randomized control trials that compressive stockings or foot pump reduce the risk of asymptomatic DVT in elective orthopaedic surgery, foot pump being more effective then compressive stockings in the reduction of the risk of proximal DVT. Aspirin reduces the risk of asymptomatic DVT and of PE by about one third in patients undergoing elective orthopaedic surgery. While not statistically significant there was a similar reduction in total mortality. Aspirin seems to be more effective then Warfarin in the reduction of proximal DVT and the risk of bleeding after THR appears to be low. With regards to the Heparins, both UFH and LMWH reduce the risk of asymptomatic DVT by 50% but they have no effect on symptomatic PE or mortality and both have a non significant trend to increase major bleeding. It is to be added that in a

recent UK cohort studies the use of heparin prophylaxis and mechanical prophylaxis was not associated with significant reductions in clinical VTE or mortality when compared to the use of mechanical prophylaxis only. The additional benefit of UFH or LMWH compared to routine early mobilisation, mechanical prophylaxis and aspirin is therefore unclear. There is a debate as to whether extended LMWH (4 to 5 weeks after surgery) provides any benefit. Warfarin adjusted to INR 2.0 to 3.0 is similarly effective to UFH or LMWH prophylaxis in prevention of asymptomatic DVT and symptomatic VTE after THR. The problems are the regular monitoring and the increased risk of bleeding.

Interestingly, in a recent population based study on venous thromboembolism associated with hip and knee replacement over a ten year period, Howie et al [14] note that despite an increase in the use of routine chemical VTE prophylaxis over the last ten years (from 50% of orthopaedic surgeons 20 years ago to 80 % in 1996). The incidence of venous thromboembolic disease and fatal pulmonary embolism has not decreased.

Fondaparinux, a pentasacharide which binds anti-thrombin and enhances its activity towards factor Xa but is devoid of activity against thrombin was brought onto the market. It has been shown to have a benefit over a low molecular weight heparin in risk reduction of venous thrombo-embolism after orthopaedic surgery [15] . Furthermore it seems that its cost to the health care system is inferior when compared with a low molecular weight heparin [16] .

USE OF DRAINS

The rationale for the use of drains in THR is to reduce the incidence of wound haematoma and bruising but most studies who identified an increase in these complications failed to note serious consequences such as infection or wound dehiscence . Another advantage highlighted by proponents of the use of drains is with regards to the peri-operative blood salvage which has been shown to reduce the need for allogenic blood transfusion, but some authors have suggested that it only has a place in revision surgery or where substantial blood loss is anticipated. When assessing the use of drains in THR it is important to choose an appropriate outcome measure. The most important one of which being deep or superficial infection.

Walmsley et al [17] showed that the only significant difference when using drains Vs no drain is the reduction in the need of transfusion in the second group. There was no difference between the two groups with regards to other outcome measures of revision, thromboembolism, pre- and post-operative levels of haemoglobin, HHS and length of stay. Gonzalez della Valle et al did an RCT on 104 THR operations assessing the use of drains [18] . There were no difference in blood transfusion rates, haematoma, infection and thromboembolism. There was however a significant reduction in hematocrit and a longer length of stay in patients who had received a drain.

Although there is significant evidence that the use of drains only adds cost and seems to increase the need for transfusion, they are still in use in several orthopaedic units and these policies should be revised.

REHABILITATION

It is important for patients but also for the physician to understand that joint replacement is a process that extends far beyond the surgery itself. In fact as seen earlier in the article the indications, prophylaxis... are a whole part of the treatment. The post operative period with rehabilitation is also crucial in a successful outcome following total hip replacement. No RCT have been conducted to determine the most effective protocol for rehabilitation after total hip replacement.

There is evidence that preoperative interventions such as preoperative education program as well as preoperative exercise programs seem to have a positive impact on post operative outcome [19] , [20] .

With regards to the weight bearing status of post operative patients, it is not uncommon to note that the practice varies significantly between different consultants although weight bearing restrictions have been questioned. Jones et al [21] recently reviewed the current state of evidence in hip arhtroplasty in general, reviewing as well the literature for the biomechanical considerations after a total hip replacement. They emphasise on the fact that activities that have been thought to protect/strengthen the hip joint such as slow walking, non or touchdown weight bearing, and hip exercises were actually generating higher pressures on the acetabular cartilage and the hip joint then normal speed walking with full weight bearing.

OUTCOME MEASURE

It is only in recent years that the importance of the choice of outcome measure has been highlighted. In fact with the rising magnitude of evidence based medicine, it has become obvious that to compare different surgical approaches, prosthesis or bearing surfaces, one needs a well defined and

uniform outcome measure.

A major limitation in the available literature is the poor level of outcome assessment. In fact outcome measures defined as objective (rate of revision surgery, Harris hip score), seem to have a poor inter-observer reliability and therefore introduce the risk of bias within the study. Only exceptionally has the literature on THR provided evidence of outcomes based on patient satisfaction (subjective outcomes). These outcome measures have shown higher validity and reproducibility then objective, or clinician based outcome measures.

In 2000, approximately 152000 patients received a total hip replacement in the US [22] and with an ageing population, this number is expected to rise rapidly in the western world. Aware of this very lucrative business, the industry has spent millions of pounds in the development of new prosthesis and bearing surfaces. While such market competition may foster innovation, it also creates a dilemma that is central to outcomes analysis: the frequent modification of implant design outpaces our ability to measure the in vivo mechanical and clinical effectiveness of each change. Further randomised controlled trials with uniform outcome measures are necessary to assess and determine a more uniform treatment algorithm. With regards to the bearing surfaces, the metal on metal has shown promising results but the long term effects of metalosis are still to be determined. Computer assisted hip replacement have shown ambiguous results but obvious advantages such as the accuracy of placement of the prosthesis have been highlighted.

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