

58-year follow-up of a vitallium mold hip arthroplasty

A case report and literature review

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In 1948, a 10-year-old boy presented to the Royal Children's Hospital in Melbourne with painful right hip. Radiographic examination at that time revealed a slipped upper femoral epiphysis. This was treated with manipulation under general anaesthetic and plaster immobilization. At follow up after 6 months, it was noted that his right leg was shorter than his left and radiographs showed avascular necrosis in the right femoral head. He then underwent a Smith-Petersen vitallium mold hip arthroplasty at the age of 11.

He was referred to our clinic recently, now 70 years of age, complaining of weakness of the right leg that had been coming on gradually for the previous 10 years. Because of this problem, his exercise tolerance had deteriorated over the previous 18 months. He had taken to using crutches and a wheelchair to remain mobile. He denied any feelings of pain or discomfort around the hip, or numbness in the leg.

He walked with a limp, and the Trendelenberg test was positive due to abductor weakness. Movements of the hip were: flexion 60°, abduction and adduction 30° each, internal rotation 0°, and external rotation 30°. He had no fixed flexion deformity of the hip. The right leg was 10 cm shorter than the left, and the patient felt that this leg length discrepancy had progressed recently. The weakness and positive Trendelenberg test was thought to be due to shortening of the lever arm because of progressive erosion of the femoral neck (Figure). He scored 18 on the Oxford hip score and 70 on the Harris hip score. The patient was not keen to consider revision surgery.

Discussion

The idea of the mold arthroplasty was conceived by Smith-Petersen from the observation of a piece of glass removed from a patient's back that was surrounded by a synovial sac containing clear yellow fluid. The first glass mold interposition arthroplasty was inserted in 1923 with the theory of "guiding nature's repair". Unfortunately, being of glass, these arthroplasties were prone to breaking. On removal of one of these broken mold arthroplasties, it was noted that the femoral head was covered with a "firm, glistening lining". Histology confirmed this to be a mixture of fibrocartilage and hyaline cartilage (Gibson and Williams 1951).

Smith-Petersen tested many substances in an attempt to find something more durable than glass. It was not until 1937 that his dentist, Dr John Cooke, suggested vitallium. This is a cobalt chrome alloy that at the time had been recently introduced into dentistry.

Smith-Petersen put in the first vitallium mold arthroplasty in June 1938 in Massachusetts General Hospital. It was an interposition arthroplasty that articulated with both the acetabulum and the femoral head (this design was later modified to allow fixation to the femoral head, either through fenestrations to allow bony ingrowth or fixation with screws or acrylic cement. He went on to perform more than 500 of these operations (Smith-Petersen 1948) with good long-term results (Law and Manzoni 1970). Indications for surgery were broad and included: congenital dislocation, slipped upper



The vitallium mold arthroplasty 58 years after surgery.

femoral epiphysis, rheumatoid arthritis, Perthe's disease, trauma, osteoarthritis (*malum coxae senilis*) and even septic arthritis. This is considered by many to be a landmark in arthroplasty surgery, as it was the first to produce long-term, predictable results following the poor results of interposition arthroplasties such as ivory, pig's bladder, and fascia lata.

The Judet brothers modified Smith-Petersen's arthroplasty, producing their own prosthesis in 1948. This differed in that it was made of acrylic and had a stem to be secured to the femoral neck. Initial results were good (Judet and Judet 1952) but it was susceptible to wear and early failure. Isolated cases of long-term follow-up (with devices similar to Smith-Petersen's mold arthroplasty) have been recorded, involving periods of up to 47 years (Tenent and Eastwood 1998). This prosthesis heralded the advent of other stemmed prostheses similar to many used in hip arthroplasty surgery today.

Vitallium as an implant material has also stood the test of time. It is present in the manufacture of prostheses today, such as the Austin-Moore and Thompson hemiarthroplasties. Other cobalt chrome alloys are also in frequent use in implants in orthopedic surgery.

There are a few case histories in the literature of vitallium mold prosthesis surviving 45 years or more (Mahalingam and Reidy 1996, Radcliffe and Geary 1997, Landham et al. 2006, Wright et al. 2006), but at 58 years this is the longest follow-up recorded. With only a small number of these

arthroplasties available for clinical assessment with this period of follow up, it is difficult to draw any significant conclusion as to why they have lasted so well. It is also difficult to compare short-term and medium-term data between these and modern-day prostheses. Follow-up studies of vitallium mold arthroplasties have shown high levels of patient satisfaction (Law and Manzoni 1970), but at the time no formal scoring systems were available to provide an objective measure and to allow comparison with modern data. Reoperation rates were low. This may be due to the success of the operation, but may also reflect different attitudes of surgeons to revision surgery as well as differing patient expectations.

This arthroplasty did not seem to follow any of the current ideology of arthroplasty surgery, yet these cases have demonstrated excellent longevity. All 5 patients who were followed up at 45 or more years were satisfied with the results of their surgery, and none of them were willing to consider revision. With this in mind, one could certainly consider these arthroplasties to have been a success and question the current theories of arthroplasty surgery.

Consent

Consent was obtained from the patient before writing this article.

- Gibson A, Williams T H. Changes in the femoral head underlying a vitallium cup. *Bone Joint Surg (Br)* 1951; 33: 119-21.
- Judet R, Judet J. Technique and results with the acrylic femoral head prosthesis. *Bone Joint Surg (Br)* 1952; 34: 173-80.
- Landham P R, Abbas N, Jahnich H. The oldest surviving arthroplasty? *J R Soc Med* 2006; 99: 640.
- Law W A, Manzoni A. Smith-Petersen mould arthroplasty of the hip: results after 12-21 years. *Proc R Soc Med* 1970; 63 (6): 583.
- Mahalingam K, Reidy D. Smith-Petersen vitallium mould arthroplasty: a 45-year follow-up. *J. Bone Joint Surg (Br)* 1996; 78: 496-7.
- Radcliffe S N, Geary N P J. 46-year survival of a Smith-Petersen mould arthroplasty. *J Arthroplasty* 1997; 12 (5): 584-5.
- Smith-Petersen M N. Evolution of mould arthroplasty of the hip joint. *J Bone Joint Surg (Br)* 1948; 30: 59-75.
- Tennent T D, Eastwood D M. Survival of the Judet hip prosthesis. *J R Soc Med* 1998; 91(7):385-6.
- Wright D M, Alonso A, Rathiman M, Sochart D H. Smith-Petersen mould arthroplasty. An ultra-long-term follow up. *J Arthroplasty* 2006; 21 (6): 916-7.