Humeral windows in revision total elbow arthroplasty

Chris A Peach¹, Amir Salama² and David Stanley²

Abstract

The use of cortical windows for revision elbow arthroplasty has not previously been widely reported. Their use aids safe revision of a well fixed humeral prosthesis and can be used in the setting of dislocation, periprosthetic fracture or aseptic loosening of the ulnar component. We describe our technique and results of cortical windows in the distal humerus for revision elbow arthroplasty surgery.

Keywords

elbow, revision arthroplasty, technical tips, windows

Date received: 22nd December 2015; accepted: 15th January 2016

Introduction

Cortical windows have been used in lower limb revision arthroplasty surgery with good clinical outcomes and union rates for many years.¹ Their use in upper limb surgery is less well established and has been restricted primarily to studies reporting their use in revision shoulder surgery.^{2,3} We have only found one report using windows in elbow surgery. Cheung et al.⁴ included a technical description of a method used for patients undergoing revision elbow surgery for infection. The outcome of the use of cortical windows for revision elbow arthroplasty surgery has not, however, been reported previously.

We report in detail our technique and experience of using cortical windows in the distal humerus for revision elbow arthroplasty surgery.

Indications

The primary indication is the removal of a well fixed humeral prosthesis. Revision may be required for a dislocated unlinked arthroplasty, to treat aseptic ulnar component loosening in the presence of a well fixed humeral component, and when revision surgery is required to revise an ulnar periprosthetic fracture. If a window is not used, the risk in all these situations is that the humerus is fractured with significant comminution, making reconstruction difficult.

The secondary indication is in the treatment of prosthetic infection where a window may assist in the removal of cement and membrane during first-stage revision surgery.⁵

Materials and methods

In total, 108 revision elbow arthroplasty procedures were carried out at our institution between 1 January 2000 and 31 December 2011. Eighty-one elbows underwent removal of the humeral component of which 15 required a posterior humeral window osteotomy to aid in the removal of the well-fixed humeral prosthesis.

There were 10 women and five men with a mean age of 68.5 years at the time of revision (range 51.7 years to 84.4 years).

¹Shoulder and Elbow Unit, University Hospital of South Manchester, Manchester, UK

²Shoulder and Elbow Unit, Northern General Hospital, Sheffield, UK

Corresponding author:

Chris Peach, Department of Shoulder and Elbow Surgery, University Hospital of South Manchester, Southmoor Road, Manchester M23 9LT, UK.

Tel: +44 (0) 161 291 6150.

Email: c.peach@doctors.org.uk

Operative technique

Wherever possible, the skin incision utilised the previous scar. The ulna nerve was identified in all cases, superficially decompressed but not transposed. A posterior approach to the elbow joint was then undertaken, splitting the triceps as described previously.⁶ This allowed exposure of the distal third of the humerus. The level and size of the humeral window were both planned to enable adequate access to the tip of the prosthesis and cement tail at the same time as considering areas of bone deficiency and the ability to bypass the window with the revision prosthesis. Crucially, the window does not extend distally to the olecranon fossa, thereby preserving an intact bone bridge at the posterior aspect of the distal humerus. We consider this to be important because it is this part of the humerus that resists the resultant forces crossing the elbow during flexion and extension.

The corners of the window were marked with a 2.5-mm drill and a micro sagittal oscillating saw used to create a rectangle window in the posterior aspect of the humerus. The orientations of the osteotomy cuts were fashioned obliquely in an attempt to give some stability to the window when it was replaced at the end of the procedure. Despite this, stability of the window was often poor, with the window tending to fall into the humeral canal. To overcome this problem vicryl slings were passed through drill holes adjacent to the window and tied over the window (Figs 1 and 2). For larger windows, the slings also passed through drill holes in the window (Figs 3 and 4).

When a one-stage revision was performed, the tip of the humeral prosthesis bypassed the window by

at least two humeral diameters to reduce the risk of a periprosthetic fracture. For two-stage revisions, the vicryl slings prevent the window falling into the humeral canal until either bony or fibrous union has occurred.

Results

Using this window technique, the humeral components and cement were safely removed in all 15 cases. There were no intra-operative fractures. Thirteen patients had a revision humeral component inserted, whereas two had a resection arthroplasty for infection.

In all revision arthroplasties, a Coonrad–Morrey prosthesis (Zimmer Biomet Inc., Warsaw, IN, USA) was inserted.

At a mean follow-up of 39 months (range 9 months to 76 months), radiographs suggested 14 of the 15 windows had united.

Discussion

Revision total elbow arthroplasty can be an extremely challenging procedure, particularly if the humeral component is well fixed. The use of fine osteotomies to loosen cement around a well fixed humeral prosthesis can very easily result in an iatrogenic fracture. Often when this occurs, the fracture is comminuted, making reconstruction of the distal humerus very difficult. We have found the use of judiciously positioned cortical windows to be beneficial. They assist in removing the prosthesis by allowing the cement to be removed from the posterior,

Figure 1. Diagram demonstrating small window fixation with vicryl slings.

Figure 2. Technique of small window replacement. The vicryl sutures provide a sling on which the window sits. The sutures are then tied over the window.

Figure 3. Diagram demonstrating large window fixation with vicryl slings.

medial and lateral aspects of the humerus. In addition, once the implant has been successfully removed, they also assist in removal of the anterior cement and cement tail.

Repositioning the window at the end of the procedure, however, is not always easy. Even when the window

osteotomy cuts have been made obliquely, there is still a tendency for the window to fall into the humeral canal when it is replaced. To avoid this happening, we have found the use of vicryl slings to be beneficial. By firmly securing the window, it makes a one-stage revision procedure easier because control of the window during

Figure 4. Technique of large window replacement. The vicryl sutures pass through the humerus and through the window and tie over the top of the window.

re-cementing is not required. In addition, when a two-stage revision is performed, acute replacement of the window at the first stage means that the window is not found in the canal when the revision is undertaken.

One important theoretical advantage of this technique over the one described by Cheung et al.⁴ is that it preserves the crucial posterior aspect of the distal humerus. The mode of failure of a humeral component is by the posteriorly directed forces on the distal humerus.⁷ The intact distal bony bridge provides structural support after reimplantation, which may prevent loosening of the revision prosthesis. It is for these reasons that we recommend this technique for well fixed humeral prostheses.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Nelson CL and Weber MJ. Technique of windowing the femoral shaft for removal of bone cement. *Clin Orthop Relat Res* 1981; 154: 336–7.
2. Sperling JW and Cofield RH. Humeral windows in revision shoulder arthroplasty. *J Shoulder Elbow Surg* 2005; 14: 258–63.
3. Dodson CC, Nho SJ, Cordasco FA, Craig EV, Dines DM and Warren RF. Anterior humeral window for revision shoulder arthroplasty. *Tech Shoulder Elbow Surg* 2006; 7: 111–5.
4. Cheung EV, Adams RA and Morrey BF. Reimplantation of a total elbow prosthesis following resection arthroplasty for infection. *J Bone Joint Surg Am* 2008; 90: 589–94.
5. Peach CA, Nicoletti S, Lawrence TM and Stanley D. Two-stage revision for the treatment of the infected total elbow arthroplasty. *Bone Joint J* 2013; 95B: 1681–6.
6. Shahane SA and Stanley D. A posterior approach to the elbow joint. *J Bone Joint Surg Br* 1999; 81: 1020–2.
7. Trail IA, Nuttall D and Stanley JK. Survivorship and radiological analysis of the standard Souter-Strathclyde total elbow arthroplasty. *J Bone Joint Surg Br* 1999; 81: 80–4.