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Case Report

Total elbow arthroplasty in type IIIC elbow fracture: A case report

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ABSTRACT

Elbow arthroplasty is very successful in terms of pain relief, motion and function. Indications include posttraumatic osteoarthritis, acute distal humerus or proximal forearm fractures, and many others. With the present article, the authors would like to present the case of a patient who underwent total elbow arthroplasty following a car crash which resulted in the following conditions: IIIC type distal humerus open fracture, IIIC type proximal forearm open fracture, and multiple other lesions. Immediate surgical care consisted of primary wound correction and external fixation of the bones and secondary wound correction was practiced. A few months later the patient underwent total elbow arthroplasty. One year after the accident, following rigorous physical therapy, the patient has regained 45% of nerve function, 70% of muscle function and now can lead a relatively normal life. He can drive a car and use his elbow in daily activity. Although replacement arthroplasty was initially used mainly in patients with inflammatory arthritis, its indications were expanded to other conditions, which place higher demands on the implants and seem to lead to higher failure rates, but an elbow arthroplasty is a good option in complicated open fractures if we have a multidisciplinary team and the time of surgery is opportune despite the high failure risk.

Keywords: Elbow, arthroplasty, open fracture, wound correction, limb function.

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INTRODUCTION

Nowadays we see an increasing number in the usage of total elbow arthroplasties. Its indications are not yet clear, but according to the overall experience, it has some limitations. Even though our case presented a near contraindication for the arthroplasty we tried to preserve as many of the patient's comfort and the functionality of the limbs as it is possible. The aim of this research is to show that elbow prosthesis it's a good choice in fractures and despite the contraindications a type IIIC open fracture presents because of the complications, it is possible to time the intervention in the right way. This case shows, that no case is impossible to treat, almost everything depends on surgeons and the treatment choice that they use respecting the policies of infection prevention, good soft tissue covarege, good timing of the intervention. Herein, we describe our experience with this case and report on the clinical outcome.

CASE STORY

On the 17th of August 2015, a 50-year-old patient was admitted to our hospital, after a car accident, which resulted in the following conditions: IIIc type open fracture of the left distal humerus, IIIc type open fracture of the left proximal forearm with serious bone loss and contamination, injury of the radial nerve consisting in destruction of the nerve with its continuity held and lesion of the ulnar nerve consisting incomplete tear, without any arterial injury (Figure 1: a type IIIC open fracture with bone loss, soft tissue laceration, and contamination. The pacient transported already with endotreacheal intubation, evaluation of the neurological status of the limb was not possible, but circulation seemed to be ok), thoracic contusion with fracture of the left 4th and 5th ribs laterally, fracture of the 7th, 8th, 9th ribs posteriorly,

Figure 1. The injury.

Figure 3. Radiographic view of the external fixator.

minor pneumothorax. Immediate surgical care was decided to be performed, but there was a huge question mark about preserving the limb itself. The huge soft tissue laceration, the bone loss, the level of the contamination and the nerve injuries showed a bad sign about the outcome. The first surgical care consisted of cleaning the wound and debridement of the devitalized soft tissues. We performed partial resection of the humerus, which was comminuted with bone loss, and both bones of the forearm, primary wound correction and external fixation of the bones proposed in the light the contamination (Figure 3: The postoperative radiograph showing us the amount of the bone loss in the cubital area, with the external fixator applied).

3 days later a second intervention is made by the Plastic Surgery Clinic where secondary wound correction is made. They practice neuroraphy of the ulnar nerve, miorrhaphy of the triceps and they do muscle reconstruction with transplantation from the latissimus dorsi muscle (Figure 2: the wound correction. After the shortening of the limb it is almost possible to create a good soft tissue and skin coverage). The skin graft is also applied 15 days later by transplantation of split skin.

4 months after the accident the external fixator is removed (Figure 4: on the 4 months control radiograph the bony ends are viable and healed after the removal of the external fixator, the huge bone loss resulted in a 12 cm shortening of the limb), and the patient is advised to perform medical rehabilitation, with the left superior limb immobilized in an elbow functional brace with limited mobility, and almost after 1 year, in 16. March of 2016 in general narcosis with intra-tracheal intubation total elbow arthroplasty (TEA) is performed with Conrad-Morrey type

Figure 2. The external fixator applied.

endoprosthesis (Zimmer).

The patient is installed in the dorsal decubitus position, with the arm placed on the patient itself. After incision of the skin in an approx. 20 cm length, incision of the sub cutis and the amount of fibrous tissue that was formed near the fracture site. The neurovascular bundles are located and separated. One of the benefits of the Conrad-Morrey prosthesis is that the condyles do not

Figure 4. Radiographic view after removing the external fixator.

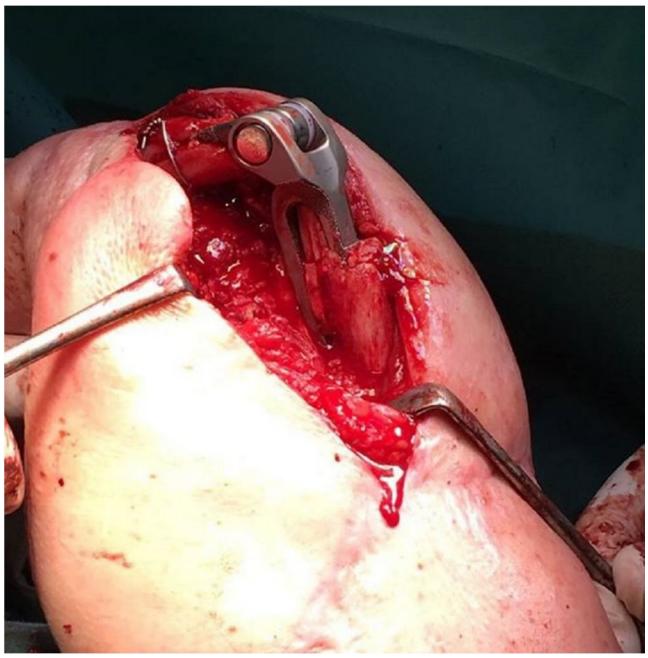

Figure 5. Position of the elbow prosthesis.

have to be reconstructed, the prosthesis itself being able to integrate completely. Bigger bone loss can be compensated with bone allografts (Hack et al., 2017). After that preparation of the humerus and ulna is made with different rasps. A cerclage band is applied to the humerus for stability. The probe implants are inserted and motion of the elbow, the canals are washed after, dried properly and high viscosity cement is injected into the canals. The implants are inserted; a 3-mm-thick bone fragment is placed behind the anterior flange of the humeral implant which was harvested from the ulnar osteotomy before its impaction (Figure 5: the posterior approach clearly visible such as the enormous posttraumatic scar tissue. After cleaning the bony ends and after insertion of the correct endoprosthesis the movements are tested. The bony fragment attached to the anterior flange of the humeral implant is also visible). The implants are then assembled and the axis is placed in the center of the hinge so that they can be locked. The elbow is placed in extension while the cement is polymerized. Reconstruction of the extensor apparatus is made with absorbable sutures. A redon drain is inserted, and wound closure is performed. Postoperatively immobilization of the upper limb is performed to keep the elbow in extension for 48 hours. As a result of the previous trauma and the bone loss the left upper limb is 12 cm shorter than the other (Figures 6 and 7: a stable and mobile joint is achieved, the bone loss is partially corrected, but the limb is still 12 cm shorter. The cement fills the bone, the endoprosthesis is situated correctly). Postoperatively also medical gymnastics and rehabilitation are advised.

One year after the accident, the patient shows some promising results. He presents some scar tissues healed without any problem. Although there is hypertrophic scar tissue in the axillar region, which limits the abduction movement of the left arm after de LD transplantation. As mentioned before thanks to the type and nature of the trauma, and the excessive bone loss the left arm is 12 cm

Figure 6. Radiographic view of the Conrad Morrey Prosthesis AP.

Figure 7. Radiographic view of the Conrad Morrey Prosthesis LL.

Figure 8. Range of motion after 3 years.

shorter: 8 cm shortening from the humerus and 4 cm shortening from the bones of the forearm.

Our patient was able to do active flexion 90°, passive flexion 100°. The pronation was 0° and the supination 40 to 60°. Stability in the elbow is mentioned (Figures 8 and 9: after 3 years of physiotherapy, the pictures show the aspect of the limb, the amount of the scar tissues, and the range of motions mentioned above). The biceps activity was acceptable, slightly moderated, but the activity of the triceps is very limited which can be explained with the bone loss, and loss of the insertion, which couldn't be fully remade later on. The prehension of the hand is relatively good but it is limited by the contraction of the extensors of the hand. Further correction of these tendons is taken into consideration to improve flexion, extension and grasping the force of the hand because the mobility of the fingers is not yet complete. That means that he regained 70% of muscle function. A very interesting thing is that the Mayo Elbow Score increased from 30 to 80, which is considered a huge change. The activity of the ulnar nerve is decreased, but the sensorial and motoric activity is slowly favorable, which means that the patient regained approx. 45% of nerve function and he can lead a relatively normal life. He regained his arm function; he can drive a car and use his elbow in daily activity. Overall we observed an increased range of motion.

On the radiograph, a good bony integration of the prosthesis can be observed, without radioulnar synostosis, with the previously mentioned shortening of the bones, the proximal parts of the forearm bones slightly deformed. The autologous bone allograft inserted into the anterior flange of the prosthesis is fully integrated (Figures 6 and 7).

Figure 9. Posterior aspect and mobility of the limb.

DISCUSSION

The flexion and extension movement is done mainly in the humero-ulnar joint, and the pronation and supination in the radio-ulnar joint (Prkić et al., 2016). As well-known

many ligaments stabilize the joint, and important vascular and nervous bundles pass near the joint. Distal humeral epimetaphyseal fractures and distal humeral intraarticular fractures are most common in elderly female patients (Kho et al., 2015; Singh and Ramachandran, 2016; Tian et al., 2015), which is explained by the osteoporosis. When it occurs in young patients it is a result of high energy trauma, mostly complex or even comminuted intraarticular fractures.

Total elbow arthroplasty (TEA) has become in the past 30 years a mainly chosen treatment option in elbow trauma cases (Mansat et al., 2014a, b). The first TEA was made for an arthritic patient with elbow stiffness, but the indications were extended over the years (Gallucci et al., 2016). It shows good results according to the extension of the range of movements, solving the stiffness, and pain control (Barthel et al., 2014). The therapeutic usage still depends on many factors as the age of the patient, the comprehension, the osteoarticular lesion itself and the periarticular lesions too (Kiran et al., 2015), as the most common complication of TEA is the ulnar nerve palsy (McKee et al., 2003), or failure of the extensor apparatus. The condyles do not have to be reconstructed and the humerus can be shortened by 2 to 3 cm (Linn et al., 2014).

In the case of open fractures, there is a high risk of infection, so the time of the replacement surgery needs to be taken into consideration. In the absence of infection signs, the TEA has good results without deep infection or any wound complications (Linn et al., 2014). It was proved though that the outcomes of total elbow prosthesis (TEA) in case of massive bone loss are not that favorable, and complication rates increase significantly (Hack et al., 2017).

Even though there was a massive bone loss in our case, the open fracture presented a near contraindication for total elbow arthroplasty, even though there are some good results in the literature (Tian et al., 2015). As the open fracture came with multiple nerve injuries the indication for the TEA was not so clear, giving us a hard time in choosing the treatment option. The first job was to achieve acceptable osteosynthesis and to create reasonable bony support for future implants. As soon as bone healing is achieved we can attend to the replacement intervention. Replacement arthroplasty of the elbow is in constant evolution. Although it was initially used mainly in patients with inflammatory arthritis, its indications were expanded to other conditions, which place higher demands on the implants and seem to lead to higher failure rates. Elbow arthroplasty is further complicated by the need to violate the extensor mechanism for exposure, the increased risk of infection, the role of the radial head, and potential clinical problems related to the ulnar nerve.

This case is demonstrating that an elbow arthroplasty is a good option in complicated open fractures if we have a multidisciplinary team and the time of surgery is opportune. This case was unique as any other case, but noone could ever tell the outcome. It was a lesson for us, and also for anyone else, that there is no impossible case, that with enough work you can achieve anything. Even in a desperate case like this any of us in our hospital should give their best to save the limb. Although the intervention itself was only the beginning, the patient faced many kinetotherapeutic exercises and he still has a lot to evolve to achieve much better and mostly painful movement ranges. Despite the hard work, and the slow results the patient is thankful, that he has a hand that he can use, even if not with a 100% efficiency. The spread of these endoprosthesises gave us the possibility to treat even untreatable and irreducible intraarticular fractures, even more than before. So if the anatomical intraoperative reduction is not possible, after the healing of the bone still exists the possibility to use any of the endoprosthesises. It is of course a limitation the age of the patient, as many elderly patients won't be able to struggle with all the kinetotherapeutic exercises and the long way to heal up. For that a very cooperative and conscious patient is needed, which can be very rare. Also the cubital region is very sensitive as many vasculo-nervous bundles pass by with very few soft tissue coverage, so injuries may happen when saving the limb is really impossible.

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