

# The burden of chronic elbow dislocations in Cambodia and early results of a cost-effective surgical approach

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## Abstract

Chronic elbow dislocation presents a surgical challenge and there is difficulty in balancing stability with early mobilisation. We present a series of 103 patients treated with open reduction via a posterior approach and provide early results of an alternative combined medial and lateral approach (Soddo technique, Anderson et al.).

Of the 103 patients, 81% initially consulted a traditional healer and the mean dislocation period was 11 weeks. There was significant loss to follow-up. Only 12 patients having undergone the posterior approach had complete datasets. The mean preoperative arc of movement was 10° and the postoperative arc was 65° at a mean follow-up of 16 weeks. Five patients treated with the Soddo technique had sufficient follow-up data. The mean preoperative arc was 20° and the mean postoperative arc was 95° (mean follow-up of 20 days). Those having undergone the Soddo technique achieved a 20° greater increase in range of movement and no re-dislocations.

## Keywords

Elbow, dislocation, open reduction, developing country

## Introduction

Worldwide, the elbow joint is the second most frequent joint dislocation after the shoulder. Of dislocations, 80% occur posterolaterally and children are most often affected.<sup>1</sup> The mechanism of injury is often a combination of axial loading, supination of the forearm and a valgus posterolateral force rupturing the capsule-ligamentous stabilisers.<sup>2</sup> In the developed world, these injuries are usually recognised immediately and receive prompt reduction.

A chronic elbow dislocation is defined as a dislocation that has remained unreduced for more than two weeks.<sup>1</sup> Due to bone and soft-tissue remodelling over this period, subsequent reduction presents a surgical challenge with variable patient outcomes.<sup>1</sup> The specific changes that prevent the possibility of closed reduction include ligamentous, capsular and triceps contracture, joint fibrosis and heterotopic bone.<sup>3</sup> There is little literature on how chronic elbow dislocations are best managed, due to the pathology rarely being encountered in the developed world. There have been several small-scale studies that have assessed outcomes following open reduction surgery but high-quality outcome

data have been lacking. In the past, it was thought that the longer the dislocation was left unreduced before surgery, the worse the functional outcome.<sup>4–7</sup> However, more recent studies have found that there is no difference in outcomes regardless of the time since injury.<sup>8,9</sup> Still, there remains controversy over how this injury is best managed. Documented approaches include closed reduction, open reduction with K wire

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fixation, collateral ligament release and repair, cruciate ligament reconstruction, triceps lengthening, hinged external fixators, excision arthroplasty, arthrodesis and total elbow replacement.<sup>10</sup> With these techniques, there is difficulty in balancing the need for postoperative stability and allowing for early range of motion.<sup>11</sup> A novel technique, developed by Anderson et al. at the Soddo Christian Hospital in Ethiopia, using combined medial and lateral approaches to the elbow joint, has recently been published and shows promising results.<sup>12</sup> This surgical approach avoids the need for triceps detachment and immobilisation with pins/braces, allowing mobilisation as early as two days postoperatively. It has been shown to be beneficial regardless of the chronicity of the dislocation and age of the patient.<sup>12</sup>

Chronic elbow dislocations are a relatively common pathology in developing countries.<sup>12–14</sup> This is largely due to the continued use of traditional healers, who often use counterproductive ‘bone-setting’ techniques. One such country is Cambodia, where our study was conducted. Traditional healing largely consists of bamboo splints holding the elbow in an extended position (Figure 1); not only does this compound the disability, such healers can charge more than medical professionals for their services.<sup>15</sup> The Children’s



**Figure 1.** Example of a bamboo splint applied by a Khmer traditional healer.

Surgical Centre (CSC) in Phnom Penh specialises in free-of-charge surgery and rehabilitation for disadvantaged Cambodians, both children and adults. Here, there are a large number of patients who present weeks to months after sustaining an elbow dislocation, travelling long distances from throughout Cambodia for treatment.

Historically, the most common surgery performed for these patients was Speed’s procedure,<sup>4</sup> an open reduction of the elbow via a posterior approach, with triceps detachment and V-Y lengthening to achieve reduction and improve flexion. The elbow is temporarily pinned at 90° flexion with a trans-articular ulnohumeral pin. The downfall of this technique is the need for extended elbow immobilisation to prevent instability, risking stiffness and triceps weakening.<sup>12</sup> Since many patients are unable to return for follow-up, early mobilisation without the need for surgical pins or braces would be optimal for our population.

The first part of our study focusses on the burden of chronic elbow dislocation at CSC. We present data from a large cohort of patients presenting with chronic elbow dislocations. Patient demographics are discussed and functional outcomes analysed from the subset of patients who underwent Speed’s posterior approach for reduction. We also consider how management and follow-up for our population may be improved. In the second part of our study, we present early results from a subset of patients who underwent the aforementioned Soddo technique.<sup>12</sup>

## Methods

The present study was conducted at a free-of-charge Cambodian surgical centre specialising in the surgical care and rehabilitation of disadvantaged and disabled Cambodians. A retrospective search of the electronic patient database from 2012 onwards for ‘elbow’ was conducted. This yielded 288 results, of which 103 were chronic dislocations. Both electronic and paper notes (where available) were used to collect data on patient demographics, mechanism of injury, preoperative and postoperative range of movement, complications and follow-up.

In addition, 12 patients were treated with the Soddo technique and postoperative management plan. Those with sufficient follow-up time (nine patients) were contacted for a follow-up consultation. Of these nine patients, five had preoperative and postoperative data available. Three of these patients consented to return to CSC for their Mayo Elbow Score to be evaluated.

Ethical approval was obtained through the Institutional Review Board (IRB) and all patients consented to their photographs and results to be used for research and teaching purposes before treatment at CSC.

T tests were used to perform comparison analysis between patient groups and  $P$  values  $< 0.05$  were considered statistically significant. All statistical analysis was conducted using GraphPad Prism 7.01 (GraphPad Software, Inc., La Jolla, CA, USA). Degrees of movement at the elbow joint are rounded to the nearest whole number.

### The Soddo technique

The technique outlined below was developed and described by Anderson et al.<sup>12</sup>

The elbow is exposed through both medial and lateral approaches, sparing the extensor mechanism. The ulnar nerve is identified and mobilised anteriorly. Bilaterally, anterior and posterior soft tissue flaps to the level of the bone are formed. The soft tissue and ligamentous attachments are preserved within the sleeves by sub-periosteal dissection.

The distal humerus is then delivered out of either the medial or lateral incision (Figure 2). Fibrotic scar and heterotopic ossification are cleared from the olecranon and coronoid fossa while preserving any underlying articular cartilage. The elbow is reduced with the ulnar nerve transposed anteriorly. The soft-tissue envelope is repaired as sleeves using heavy non-absorbable suture through bone tunnels in the medial and lateral epicondyles.

Anderson et al.<sup>12</sup> describe occasionally using a 20-gauge needle to puncture the triceps percutaneously to release an overly tight triceps. We have not found this to be necessary so far. Immobilisation via pins, wires or external fixators is avoided, thus allowing for early mobilisation. The skin is closed and a drain inserted.

Postoperatively, the elbow is kept in a sling at 90° flexion. Two days after surgery, elbow flexion exercises from 90° within a sling are started under the guidance of a physiotherapist. Extension beyond 90° is not



**Figure 2.** Intraoperative photographs using the Soddo technique.

started until two weeks postoperatively. After one month, patients are instructed to lift a can or bottle with increasing amounts of water to aid extension.

Indomethacin is prescribed for one month if significant heterotopic ossification was observed intraoperatively and if the dislocation was less than six months old.

## Results

### Patient demographics

Of the patients identified, 57% were female and 43% male. The mean age at time of presentation was 32 years (age range = 5–65 years). Patients presented from throughout Cambodia; unfortunately very few had occupation or hand dominance recorded.

### Mechanism of injury and associated fractures

The majority of injuries were caused by a fall, 38% of which were from a height < 1 m. This was followed by motorcycle accidents (18%). Bicycle, animal and sports-related injuries each made up 4%. 'Other' injuries included farming-related injuries and those not specified on documentation (Figure 3). Of the patients, 35% had sustained a fracture associated with their dislocation, though the precise nature of fractures was seldom documented and malunions were not addressed at the time of surgery.

### Treatment

The majority (67%) had been treated with the traditional Speed's procedure. Of the patients, 17% did not undergo surgical treatment; closed reduction was performed in 4%, non-operative treatment in 4% and 9% refused treatment. Eleven percent of patients underwent the newer Soddo technique with early movement postoperatively.

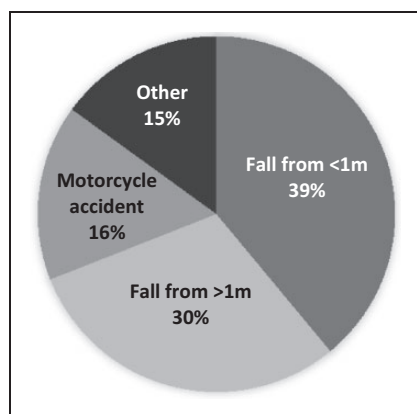


Figure 3. Mechanisms of injury.

Of note in our specific patient population, 81% of patients had documentation that they had been treated by a Khmer traditional healer before consulting with a medical professional. It is anecdotally known that elbow immobilisation with a bamboo splint is their treatment of choice (Figure 1). The mean delay to treatment in this population was 11 weeks (range = 4–54 weeks).

### Speed's procedure outcomes

#### Complications and length of hospital stay

Fifteen patients who underwent Speed's procedure suffered a postoperative complication. Complications were as follows: five wound infections; three unintentional exposed hardware; two failed reductions; two intraoperative fractures; one haematoma; one tourniquet palsy; and one failed skin closure. No re-dislocations or instability were recorded.

Thirty-seven patients had their length of hospital stay documented, the mean stay being 12 days (range = 2–64 days). Seven of those patients who suffered a complication had their length of stay recorded; they had a mean stay of 26 days (compared to eight days for those who had no complications).

### Follow-up

Forty-five patients had follow-up arrangements documented at discharge from initial surgery; the mean time to planned follow-up was five weeks (range = 1–24 weeks). Of these patients, 26 did not attend their follow-up appointment. Conversely, six patients had subsequent follow-up data despite no documentation of follow-up being planned. Therefore, data on postoperative function were available for 25 (36%) patients.

### Range of movement

Preoperative range of movement was recorded for 36 patients. The mean arc of movement of the elbow was 14° (range = 0°–100°; mean fixed flexion deformity [FFD] 3° and mean flexion 17°). Twenty-five patients had postoperative arc of movement documented and the mean for these patients was 54° (range = 0°–145°; mean FFD 36°, mean flexion 90°). Only 12 patients had both preoperative and postoperative measurements recorded that would allow for assessment of functional improvement. These 12 patients had a mean preoperative arc of 10° (range = 0–45°; mean FFD 3°, mean flexion 13°) and a mean postoperative arc of 65° (range = 0°–145°; mean FFD 34°, mean flexion 98°). For these patients, the mean follow-up time at which eventual arc of movement was recorded was at 16



weeks (range = 1–40 weeks). These patients achieved a significant improvement in their arc of movement of 55° ( $P=0.004$ ).

### Soddo technique outcomes

Twelve patients have undergone the Soddo procedure at CSC so far. Of these 12, three did not have sufficient follow-up time for analysis. Of the remaining nine, five had sufficient follow-up data or consented to return to CSC to be evaluated. Three patients returned and had their postoperative Mayo elbow score recorded.

The mean preoperative arc of movement was 20° (range = 0°–95°; mean FFD 17°, mean flexion 37°). The mean postoperative arc of movement was 95° (range = 5°–145°; mean FFD 30°, mean flexion 125°) at a mean of 20 days postoperatively (range = 18–22 days).

The mean difference in arc of movement for all patients was 75° ( $P=0.004$ ). Notably, no patients had re-dislocation. Three patients returned to have their Mayo scores evaluated and scored 80, 90 and 100, respectively (mean score = 90) at 22 days postoperatively.

An unpaired T test was used to assess whether there was a significant improvement in the postoperative arc of movement compared to patients who underwent Speed's procedure. On average, patients who underwent the Soddo technique achieved 20° greater increase in arc of movement between preoperative and postoperative measurements than those having the posterior approach (Table 1). However, this difference was not statistically significant ( $P=0.274$ ) given the small numbers for comparison. It is also worth noting that the duration of follow-up was markedly shorter in the Soddo group (20 days) compared to the patients who underwent Speed's procedure (16 weeks) which might underestimate the eventual improvement in range of movement for this newer procedure. No complications were observed in this group of patients.

**Table 1.** Comparison between Speed's procedure and Soddo technique.

|  | Speed's procedure<br>(n = 12) | Soddo technique<br>(n = 5) |
|--|-------------------------------|----------------------------|
| Mean preoperative range of movement (°)  | 10                            | 20                         |
| Mean postoperative range of movement (°) | 65                            | 95                         |
| Mean follow-up time (weeks)              | 3                             | 16                         |
| Complications (n)                        | 4                             | 0                          |

### Discussion

Our study is a description of the largest number of chronic elbow dislocations to date. Our results from Speed's procedure showed an average increase in arc of movement of 55°, which is similar to that observed by Coulibaly et al. and Maheswaran and Kamalanathan, who achieved an increase of 59° and 56° postoperatively, respectively. Both of these studies also used a posterior approach to the elbow.<sup>16,17</sup> This technique has been widely used and has been shown to be a safe and beneficial intervention. Subsequent instability is rare but stiffness is significant.

The traditional posterior approach to the elbow with V-Y triceps plasty was first described by Speed in 1925.<sup>4</sup> Now, however, many authors are of the opinion that functional outcomes are optimised when triceps detachment is avoided as it can cause triceps weakness, delayed physiotherapy and increased postoperative pain.<sup>11,12,16</sup> This has led to novel techniques being trialled in an effort to further improve the management of chronic elbow dislocations. Anderson et al.<sup>12</sup> recently published their results of a novel technique for surgical reduction of chronic elbow dislocations (Soddo technique). In their series, a total of 36 patients underwent surgery and were followed up with functional assessment and radiographs. The mean time to follow-up in their population was 22 months and the mean postoperative arc of motion was 101° (range = 50–140°).<sup>12</sup>

Use of the Soddo technique at CSC has achieved some promising early results thus far, with patients reporting contentment with their results and an overall improvement in postoperative arc of movement. Our results suggest that this technique is a safe and possibly preferable technique to the previously used Speed's procedure. Anderson et al. made no comparison to previously used techniques; however, we have shown that it may achieve a greater postoperative arc of movement than Speed's procedure when performed by the same surgeons in the same institution. This is, however, limited due to our small sample size and short follow-up. Anderson et al. achieved a greater arc of motion postoperatively than our population; however, our patients had a much shorter follow-up time, and so further functional improvements may be seen with longer follow-up and rehabilitation.

This technique may be especially beneficial in the context of our patient population as it allows for early mobilisation and negates the need to return for pin removal or re-operation. With any new surgical technique, there is also likely to be an element of a learning curve for the local surgeons, so it may be expected that outcomes from this procedure will improve further as this technique increasingly is used.

Quality of follow-up and documentation is inherently difficult in a healthcare setting such as this. A standardised documentation system may help this and use of the Mayo elbow score would be a simple and widely recognised way to assess functional status. The Mayo elbow score allows for assessment of elbow function and morbidity, taking into account range of movement but also a pain score and ability to carry out activities of daily living.<sup>18</sup> Many of our patient population are lost to follow-up and in order to combat issues in returning to hospital a possible solution to this could be telephone consultation. While this would not allow for a physical joint examination it may be a viable option for those patients who are unable to return to hospital and have limited access to other forms of healthcare. This is something that has already begun to be trialled for health delivery in Cambodia.<sup>19</sup>

## Conclusions

It cannot be underestimated that the prevention of chronic elbow dislocations will provide better outcomes for patients. However, when surgical intervention is required, a safe and reliable approach that allows for both stability and early mobilisation would be optimal. Our results show that the novel Soddo technique may be preferable to the previously used Speed's procedure. Through preservation of the triceps mechanism allowing early movement, patients may achieve an improvement in their range of movement and no further procedures or pin removal are necessary. A stable joint was achieved with no re-dislocations or other complications. It is hoped that with further use of this technique improved results will be seen. In order to better assess the results of this technique, a standardised assessment tool could be formulated and routine use of scoring tool such as the Mayo elbow score should be implemented.

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