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The clinical utility of immediate post-operative PACU plain film radiographs following uncomplicated open Latarjet procedure – An institutional series of consecutive patients

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ABSTRACT

Background: Immediate post-operative plain film radiograph x-rays in PACU following open Latarjet procedure are often ordered as routine. However, such radiographs utilize institutional cost and time, whilst potentially exposing patients to often-unnecessary additional radiation. This study sought to evaluate whether routine immediate post-operative radiographs following uncomplicated open Latarjet procedures impacted clinical decision-making in our institution.

Methods: From 2017 to 2020, patients who underwent open Latarjet procedure by one of four fellowship-trained upper limb surgeons at a single institution were included in this study. Post-operative radiographs taken immediately in PACU were reviewed to determine if any reported radiographic findings impacted on clinical decision-making in the immediate post-operative setting. SPSS was used for descriptive statistics.

Results: A total of 337 patients underwent an X-ray in PACU immediate after uncomplicated open Latarjet procedure. Overall, 98.5% were male (n = 332), the mean patient age of included patients was 22.9 ± 4.2 years. No patient had an abnormal finding on their post-operative x-ray. Two patients returned to the operating room in the immediate post-operative period, both requiring washout and debridement due to haemtoma or superficial wound infection.

Conclusion: The findings of this study suggest that the use of post-operative plain films in PACU following open Latarjet procedure remains a costly use of resources, with little ultimate impact on clinical decision making in the short-term post-operatively.

Level of Evidence: IV – Institutional Case Series of Consecutive Patients.

1. Introduction

Shoulder dislocations remain a common presentation to emergency departments worldwide, with the dislocation rate estimated as 42 in 100,000 people annually.[1,2] Additionally, the incidence of anterior shoulder instability in the general population is reported as approximately 2%, with higher incidence in athletes, with rates reported up to 15%.[3,4] Although still a topic of debate amongst shoulder surgeons, the open Latarjet (OL) procedure is often favored in the management of patients with bone loss at the glenoid or large volume Hill-Sachs lesions following dislocation, or in cases of failed prior stabilization procedures.[5–9]

For many surgeons, common practice involves the routine use of immediate post-operative plain film radiographs in the post-anesthesia care unit (PACU) following shouder surgery.[10] Such radiographs are often performed to confirm humeral head or arthroplasty position with respect to stability, but also to inform surgeons regarding immediate post-operative clinical decision-making. Although somewhat limited, post-operative radiographs following OL procedure continue to be considered an informative radiological evaluation regarding stabilization screw position and coracoid fixation.[11] Routine usage of such radiographs may warrant further re-consideration, as they are time consuming, costly and use finite resources, whilst also raising potential radiation exposure for patients.[10]

Plain film radiographs in PACU grants clinicians the ability to make clinical decisions post operatively, particularly with respect to the

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knowledge of accurate hardware positioning. Therefore, this study sought to evaluate whether routine immediate post-operative radiographs following uncomplicated open Latarjet procedures impacted clinical decision-making in our institution. We hypothesized that routine PACU radiographs following uncomplicated OL procedures have little to no impact on clinical decision-making immediately post operatively.

2. Methods

2.1. Study design

Following receiving ethical approval by the institutional review board, a retrospective review was carried out of all patients who underwent an OL procedure at our institution over a 3-year period between March 2017 and March 2020 under one of four orthopaedic surgeons. This study's inclusion criteria involved both 1) open Latarjet procedure in our institution, and 2) plain film radiograph performed immediately in PACU post-operatively.

Patient characteristics and preoperative data were recored, including (1) patient (2) age at time of surgery in years, (3) gender, (4) surgery side, and (5) previous shoulder surgeries, were collected. A review of electronic patient records was carried out for all patients who underwent OL procedure, with review of all plain films performed in PACU post-operatively. Routine plain film radiographs in PACU tend to be filmed in a Grashey view; one single radiograph demonstrating a true anteroposterior view of the glenohumeral joint. It is routine practice for these post-operative plain film radiographs to be reported by a fellowship trained musculoskeletal radiologist, typically within 24 h of filming. For all patients, medical notes were reviewed post-operatively to assess whether return to the operating room was required based on the findings of these PACU x-rays. Endpoints of interest included: 1) PACU x-rays reported by a consultant musculoskeletal radiologists with a) abnormal findings, or b) no change in findings from pre-operative plain films, and 2) necessity for return to the operating theatre for further surgery immediately post-operative (within 24 h of index procedure) based on the findings on PACU plain film radiograph, namely the first 30 days post-operatively.

2.2. Surgical technique

As previously described,[5,12,13] stabilization was performed for all patients under general anesthesia, with patients being positioned in the beach-chair position post-anesthesia. A skin incision measuring approximately 5 cm was made along the axillary fold beyond the coracoid tip. Following deltopectoral interval development, the conjoint tendon and coracoid were exposed with a Hohmann retractor being placed dorsally on the coracoid. Thereafter, release of pectoralis minor off the coracoid medially was carried out and the coracoacromial ligament was divided laterally, leaving a stump of approximately 1 cm attached to the coracoid to be used later for capsular repair, according to surgeon preference. An coracoid osteotomy was then performed at the junction between its body and base using a saw angled at 90°, aiming to harvest a minimum 20–mm long graft. The Hohmann retractor was removed before preparing the coracoid to minimize soft tissue tension. The donor area at the coracoid base was coagulated, with bone wax used as a seal to prevent potential hematoma. A high-speed burr was then used to prepare the undersurface of the coracoid, with the first drill hole was placed centrally (varies 2.5 mm and 3.2 mm amongst surgeons in our institution), approximatelt 5 mm proximal from the coracoid tip. The subscapularis was thereafter split at the junction between its middle- and lower third to expose the capsule. Next the capsule was split to allow access to the anterior scapular neck. A Hohmann retractor was carefully placed on the medial scapular neck allowing visibility of the anterior aspect of the glenoid. After removal of any remnant osseous fragments and soft tissue, the anterior glenoid was freshened manually using a high-speed bur. An inferior drill hole was then placed 5 mm above to the inferior margin of the defect. Following measurement and use of a tap, coracoid graft fixation to the glenoid was performed using a standard partially threaded, cancellous screw (varies between 3.5 mm and 4.5 mm amongst surgeons in our institution). Thereafter, a second drill hole and subsequent screw fixation was performed 10 mm superior to finally secure the graft in situ. Capsular repair to the coracoacromial ligament followed using 2–3 nonabsorbable stitches, with the arm in approximately 30° of external rotation and abduction, to prevent stiffness. Application of topical vancomycin into the wound was used in attempt to minimize potential risk of wound infections with Cutibacterium acnes. The arm was immobilised in abduction for 3–4 weeks after surgery.

2.3. Statistical analysis

SPSS (version 26; IBM Corp, released 2013) was utilised for appropriate descriptive statistical analysis. Descriptive statistics are carried out on continuous and categorical variables. Statistical significance was demmed in cases of a value of P of <0.05.

3. Results

3.1. Patient demographics

Overall, 337 patients who underwent a plain film radiograph in PACU immediately following uncomplicated OL procedure in our institution were included in this study. The mean age of the patients was 22.9 years ± 4.2 years. This included a total of 332 male patients (98.5%). These findings are illustrated in Table 1.

3.2. Radiograph findings and post-operative course

This investigation found that none of the included patients had abnormal findings on their PACU plain film radiograph. Immediate post-operatively, only 2 patients had to return to the operating theatre for further procedures. Both patients underwent wound debridement and irrigation; one each for superficial wound infection and hematoma formation. This is summarized in Table 2.

4. Discussion

This study reports that the use of immediate plain film radiographs in the PACU following OL procedures appears to have minimal impact on clinical decision-making and remains costly of resources for the institution. Routinely, plain film radiographs are performed immediately after OL procedures in the PACU, which is a practice that our study challenges. Despite our study calling into question the scientific rationale for immediate post-op plain films, none of the four shoulder surgeons who participated would change their current approach of routinely ordering a PACU X-ray post open Latarjet procedure, as being medicolegally conscious is of consideration in case of potential subsequent complication in the weeks that follow surgery.

Among the 337 patients that were analyzed, no PACU radiographs had findings that led the surgeon to revise his or her reconstruction or alter management in the initial post-operative phase. Several previous studies have also suggested that immediate post-operative radiographs did not change treatment or outcome after shoulder procedures.[10,14] In a

Table 1
Patient demographics.

Patients	337
Age (yrs ± SD)	22.9 ± 4.2
Gender (M/F)	332/5

F; Female, Male; Male; SD; Standard Deviation, Yrs; Years.

Table 2
X-ray findings.

Abnormal Radiograph(s)	0 (0.0%)
Further Surgeries	2 (0.6%)
Type of further procedure	2 Debridement & Irrigation
Indication for further surgery	1 Wound Infection & 1 Hamatoma Formation

retrospective comparison, Namdari et al. reported their outcomes comparing 283 patients who underwent shoulder arthroplasties followed by a PACU radiograph versus 241 patients who had their first post-operative radiographs performed at an interval, and found that no immediate post-operative images changed management.[14] Conversely, in patients who had their post-operative imaging performed at a later date, 83% of these images were deemed adequate to serve as baseline radiographs. Furthermore, Villacis et al. highlighted similar findings in their study which included 157 patients who underwent immediate PACU radiography following reverse total shoulder arthroplasty.[10] Immediate post-operative radiographs were deemed unremarkable by fellowship-trained musculoskeletal radiologists for 100% of patients, whilst 13 patients had abnormal findings reported in their radiograph during the initial 3-months post-operatively; of whom 12 patients required a revision surgery, of which 9 were instability cases.[10] Moreover, in their study, Dempsey et al. examined 160 patients who underwent total anatomic shoulder arthroplasty with routine plain film radiographs performed at 2 weeks, 6 weeks, 4 months and 12 months post-operatively, concluding that there is a lack of clinical significance and poor economic value in obtaining routine post-operative plain film radiographs post-total shoulder arthroplasty.[15] This literature potentially calls into question perceived clinical benefits of plain-film radiographs in the immediate, or sub-acute, post-operative phase.

As the prevalence of Latarjet procedures is steadily increasing with very satisfactory clinical outcomes reported in the long-term, potential financial burden of routine PACU plain films following open Latarjet procedure should be considered.[16,17] Previous literature has highlighted the significant costs associated with routine PACU plain films in the immediate post-operative setting following hip and knee arthroplasty.[18,19] Charges associated with obtaining an immediate PACU radiograph after Latarjet surgery can be significant, with Namdari et al. emphasizing that the total charges billed from radiographic assessment was $64,524 for a group of 283 who received immediate post-operative imaging.[14] Additionally, Dempsey et al. echoed this finding and noted that the per-patient expense was $1776.76 per patient.[15] Likewise, Villacis et al. calculated the typical amount billed for immediate post-operative radiographs to be $544.00 per patient.[10] However, although the costs were not evaluated in our institution as a key component of this study, it is believed by the authors that our institutional costs for plain radiographs would be less than those established above.

Despite our findings, a few important reasons why surgeons continue to obtain immediate post-Latarjet radiographs remain.[20] Firstly, the use of x-ray in PACU post-open Latarjet procedures immediately post-operatively allows the surgeon an understanding as to the radiological appearance of the hardware in the operated shoulder.[21] This may be compared directly to that obtained at the patient's first post-operative visit, which some surgeons at our institution conduct 2 weeks after, allowing fair comparison to the immediate post-operative outcome, which may been necessary in cases of potential medicolegal investigation[15] or in the event of post-operative trauma in the interval between discharge from hospital and attendance at the first post-operative outpatient clinic visit. Moreover unlike arthroplasty procedures,[22] it is acknowledged that although it is unlikely to suffer an instability episode following an open Latarjet procedure by the time the patient gets to the recovery room, another key rationale for performing early post-operative film is to ensure that the screw position is satisfactory, without any potential intra-articular involvement.[21] Nonetheless, spotting these findings would depend on the skill and expertise of the radiographer in achieving optimal views, as well as the radiologist at hand, as there is a potential that some may not appreciate all of the technicalities of the procedure. With respect to this, many surgeons may rely solely on their own interpretation of the PACU plain films obtained immediately post-operatively, as perhaps they alone have a more full understanding of not only the technical nuances of the surgery, but the potential failing of open Latarjet procedure as well.[20]

To build on our study that only investigated immediate plain films following open Latarjet procedures, future investigations can compare different time points to determine when is the most clinically useful and cost-efficient imaging time-point after Latarjet procedures. Moreover, it may be worthwhile to complete a larger study to identify any specific patient populations, via demographic information for instance that would benefit from receiving an immediate post-operative film. Furthermore, it is also worth evaluating the role of radiographs in routine follow-up and whether it has a role in the decision to allow athletes return to play, with advanced imaging potentially playing an additional role.[23,24]

4.1. Limitations

Although a structured data abstraction protocol was implemented, there are inherent limitations to all retrospective reviews. It is noted that studies like this are only reflective of the select group of patients chosen from our institution, meaning that the patient sample we selected likely share certain common characteristics that may not be expansively representative of a larger group of patients. Furthermore, the experience of each individual radiographer and radiologist may vary, so this could also have implications when analyzing our results. Also, this study did not compare the PACU image with subsequent imaging results, so a next step could be to compare these two sets of radiographs and analyze whether any differences are associated with overall clinical outcome.

5. Conclusion

The findings of this study suggest that the use of post-operative plain films in PACU following open Latarjet procedure remains a costly use of resources, with little ultimate impact on clinical decision making in the short-term post-operatively.

Ethical approval

SAREB02/12/18HM/NF.

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