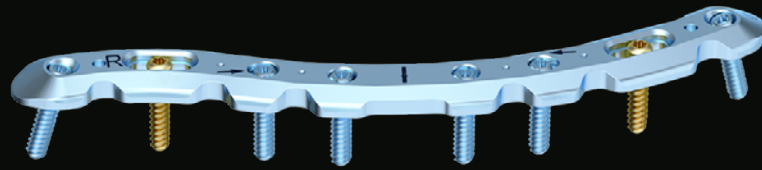


CASE STUDY



Management of recalcitrant non-union of the clavicle with a free vascularized medial femoral condyle corticoperiosteal bone flap

The Surgeon

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Eugene Ek is a fellowship-trained hand, elbow and shoulder surgeon, specializing in arthroscopic and reconstructive surgery of the upper extremity at the Melbourne Orthopaedic Group. He is active in both teaching and in clinical and biomechanical research and has published over 100 peer-reviewed research articles and multiple book chapters.

Eugene Ek is also actively involved in training both local and overseas surgeons and is currently a co-supervisor of the Melbourne Orthopaedic Group Shoulder/Upper limb Fellowship and also the Dandenong Hand Fellowship.

The Case



Patient Profile

A 26 year old, professional horse rider presented to our institution with a midshaft atrophic non-union with a defect of approximately 3 cm. Previously, she has had two failed attempts at internal fixation. The second operation was supplemented with iliac crest bone graft. Her third operation involved removal of the plate, debridement and biopsies taken for microbiology. Low grade infection was ruled out.



Picture 1: Index operation with initial fracture fixation.

Picture 2: Revision operation. Re-fixation of non-union, supplemented with iliac crest bone graft.



Picture 3: Third operation. Plate removal and debridement and biopsies to exclude low grade infection. Note 3 cm defect and atrophic non-union.



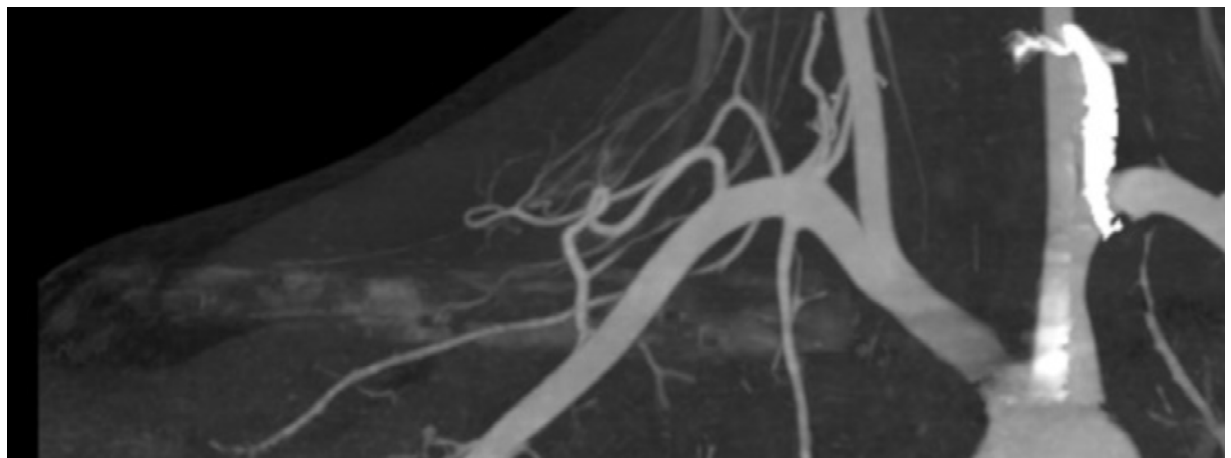
Clinical Findings/Preoperative Analysis

The patient was experiencing pain and weakness on overhead movements. Also, there was a clear cosmetic deformity. X-rays of both clavicles show that she had a 3 cm shortening of the right clavicle.



Surgical Treatment

A preoperative angiogram was performed to confirm that the recipient vessel, the transverse cervical artery, was patent.



Picture 4: Preoperative angiogram to confirm the functionality of the recipient vessel, the transverse cervical artery.

We performed a revision open reduction and internal fixation of the clavicle fracture non-union using a Medartis 2.8 superior 10-hole midshaft locking plate. The defect was reconstructed with a free vascularized, medial femoral condyle corticoperiosteal bone flap, harvested from the right knee.



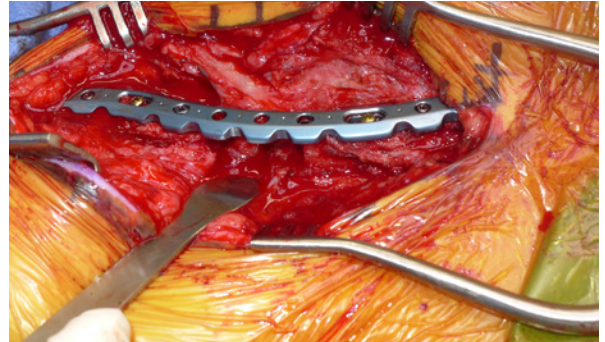
Intraoperative Findings

The fracture ends of the bone were mobilized. The clavicle was noted to be extremely sclerotic and atrophic. This was debrided and intramedullary reaming was performed.

The clavicle was first stabilized with the Medartis plate, with restoration of the clavicle length, as previously determined from the contralateral clavicle length.



Picture 5: Intraoperative view of the anthropic non-union with an almost 30 mm defect.



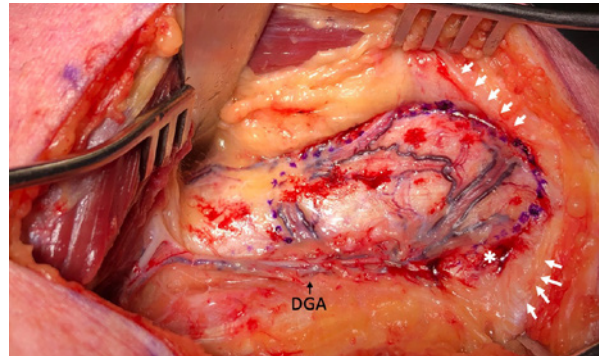
Picture 6: Initial stabilization of the non-union with a superior 10-hole midshaft plate.

The medial femoral condyle bone flap was then harvested with its surrounding periosteum to enhance bone healing and revascularization of the sclerotic bone ends.

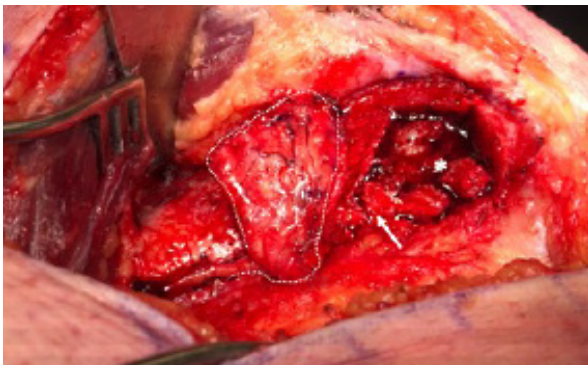
Picture 7: Medial femoral condyle with the descending geniculate artery (DGA).

Asterix: medial collateral ligament

Arrows: medial patellofemoral ligament



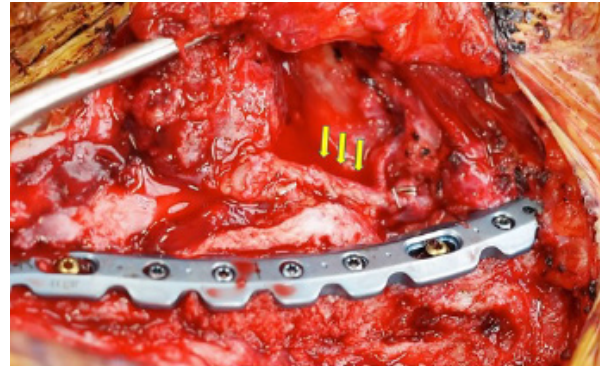
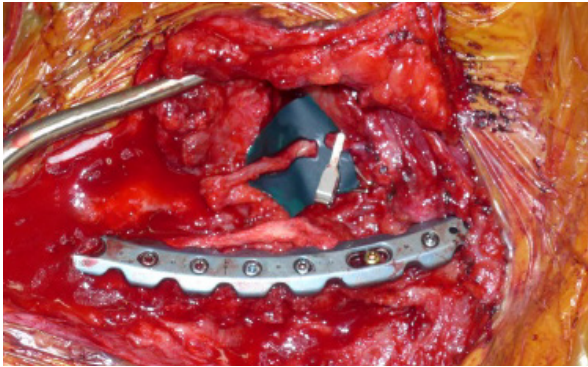
The harvested bone flap was positioned in the clavicular defect and fixed to the clavicle plate with three locking screws.



Picture 8: Harvested bone flap from the medial femoral condyle.



Microvascular anastomosis was performed to the transverse cervical artery.



Pictures 9: Insertion and fixation of the harvested bone flap with microvascular anastomosis to the transverse cervical artery (yellow arrows).



Postoperative Treatment

The patient was placed in a sling for 6 weeks. Gentle range of motion was begun immediately. No resistance or weight bearing through the right shoulder was allowed for 6 weeks.

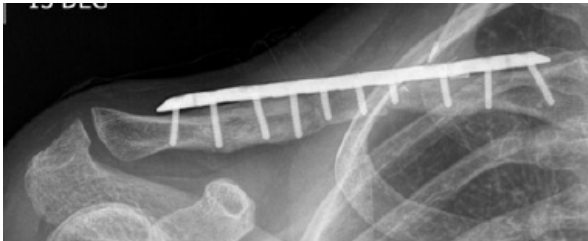
The patient required a single crutch to ambulate for 2 weeks but after then could weight bear as tolerated. Quadriceps strengthening exercises were recommended immediately.



Conclusion

Bony union was achieved at 4 months.

The patient has returned back to all activities including horse riding and is symptom free.



Pictures 10 & 11: X-rays 4 months post OP confirming bony union and restoration of clavicle length.