



# LATERAL MASS POSTERIOR CERVICAL FIXATION: A PROSPECTIVE ANALYSIS OF 612 CONSECUTIVE SCREWS IN 95 PATIENTS

*A/Prof. Lali Sekhon, Department of Neurosurgery, Royal North Shore Hospital and the University of Sydney, Sydney, AUSTRALIA*

## PURPOSE OF STUDY

Lateral mass screw fixation in the subaxial spine is a relatively new technology available for the management of cervical disease. As with every instrumentation system there are inherent risks of neurovascular injury which may potentially complicate this technique. This study evaluates the results, indications, outcomes and complications of 612 sequential lateral mass screws inserted in 95 patients by a single surgeon. Recommendations in terms of technique modification are also given.

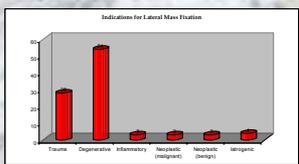
## METHODS

Over a 35 month period a total of 612 lateral mass screws were placed in 95 patients aged 12 - 96 years (56 males and 39 females), for a wide variety of conditions (see figure 3). All patients underwent screw insertion by a single surgeon using lateral fluoroscopic control (see figure 1,2 and 8 for trajectory). All patients had postoperative CT scans performed within the first week after surgery to evaluate screw position and all patients had clinical and radiographic follow-ups performed at the following time periods: day 1, 6 weeks, 3 months, 6 months, 12 months and 2 years. Follow-ups ranged from 12 months to 3 years. Patients were assessed for any immediate complications. Screw position was assessed by an independent observer. Criteria for vertebral artery injury included intraoperative identification of arterial bleeding, stroke related to screw placement or radiological appearance of invasion of the foramen transversarium by the screw tip by more than 1 mm on axial CT scanning.

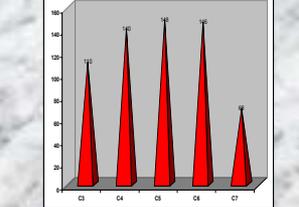


(left and above): Schematic diagrams of trajectories and postoperative imaging showing ideal screw placements

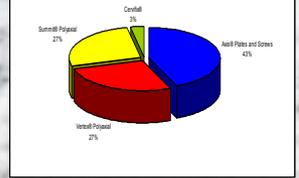
## 3. Indications for Lateral Mass Fixation



## 4. Total Lateral Mass Screws Placed Per Level



## 5. Instrumentation System



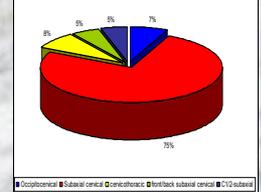
PATIENT DEMOGRAPHICS (n=95)	n	%
Males	56	58.9
Females	39	41.1
Age	58.9±14.6	
Uninsured	47	49.5
Insured	40	42.1
Veteran's Affairs	2	2.1
3rd Party	5	5.3
Workers Compensation	1	1.1
Smoking	10	10.5
Diabetes	9	9.5
Rheumatoid Arthritis	3	3.2

TECHNIQUE (n=612)	n	%
Ant/Anderson trajectory	604	98.7
Roy-Camille	6	1.0
C7 lateral mass screws	68	11.1
C7 pedicle screws	2	0.3
3.5 mm screws	604	98.7
4 mm rescue screws	8	1.3
Fixed Screws	44	7.2
Multiaxial Screws	51	8.3

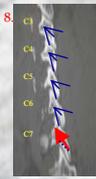
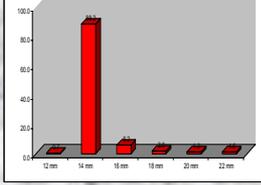
COMPLICATIONS (n=612)	n	%
Root Injury 2° screws	0	0.0
Vertebral Artery Injury	0	0.0
Dural tears (n=95)	3	3.2
Blood Transfusion (n=95)	6	6.3
Superficial Infection (n=95)	4	4.2
Deep Infection (n=95)	0	0.0
Screw Pullout (screws)	6	1.0
Screw Breakage	4	0.7
Plate Breakage (patients) (n=95)	1	1.1
Deaths (n=95)	4	4.2
C5 root injury (n=95)	1	1.1
Cord injury (n=95)	0	0.0
Adjacent Segment Requiring Surgery (n=95)	1	1.1

OUTCOMES	n	%
Range of Followup (months)	5 - 35	
Mean Followup (months)	22±16.1	
Fused at Followup (n=95)	92	96.8
Kyphosis (patients) (n=95)	3	3.2
Preop Nurick Grade (of 74 cases)	2.8±1.3	
Postop Nurick Grade (of 74 cases)	1.8±0.7	

## 6. Constructs



## 7. Screw Lengths (%)



(left): The C7 lateral mass is shallow but can be cannulated by using a steeper trajectory



(Above): Postoperative x-rays showing progressive kyphosis secondary to screw pullout that occurred in 3 patients

## SUMMARY OF FINDINGS

All screws were placed by the a modification of the Magerl and An technique (see figure 1,2 and 8) but 6 screws were converted to Roy-Camille trajectories because of screw pullout. A total of 68 C7 lateral mass screws were placed without the need for pedicle screws at this level. 44 patients underwent instrumentation with a screw/plate construct whereas the last 51 patients all utilized a multiaxial screw/rod construct. The features of these constructs are shown in figures 4-7 and in the table. Local posterior element autograft was utilized in most cases, sparing iliac crest. A fusion rate of 96.8% was found with 10% of patients preoperative smokers. In myelopathic patients, Nurick grades improved by 0.99. No patients suffered neural injury or vertebral artery injury as a result of screw placement. There were 4 deaths: 1 due to massive pulmonary embolus; 1 due to coincidental traumatic vertebral artery dissection with brainstem stroke (after a cervical fracture), 1 due to disseminated malignancy and 1 due to unrelated intracranial hemorrhage 7 months after surgery. Four superficial wound infections occurred. Three patients had screw pullouts using the Axis® system which did not require reoperation (see figure 9). These all occurred in smaller more osteoporotic C3 lateral masses. Postoperative CT scanning showed no compromise of the foramen transversarium or neural foramen. One patient to date developed a posterolateral disc bulge at C6/7, below a C3-6 fusion, 11 months after the initial surgery, which responded to a posterior foraminial decompression and one patient required extension of laminectomy for residual compression. The incidence of adjacent segment disease requiring surgical intervention was 1.1%.

## CONCLUSIONS

This study demonstrates the safety and efficacy of lateral mass fixation for a range of cervical pathologies. In most cases of subaxial disease, non-constrained plate/screw systems provide a cheaper alternative to polyaxial screw/rod constructs and can be used effectively. These however comes with a 3% incidence of kyphosis. Incidences of screw breakage are exceedingly low and pullout is more common. The incidence of adjacent segment disease at 1.1% is to date lower than that seen with anterior constructs, possible because of the 'springboard' effect of a posterior placed arthrodesis that may allow micromovement anteriorly in the disc space. Most patients can be instrumented using a modified Magerl technique with 14 mm length x 3.5 mm diameter screws. Four mm screws should be reserved as rescue screws. The C7 lateral mass can be cannulated with an adjusted trajectory allowing for the shallowness of the lateral mass. The incidence of neurovascular injury with this technique should approach zero and multilevel fixation can be performed quickly and safely with or without radiographic control. Finally, the use of local posterior element autografting avoids the morbidities associated with iliac crest graft harvesting. This technique provides an exciting straightforward tool for the management of cervical spine disease.