Asian Cadaveric Study of Anatomical Landmarks and Guidelines for Volar Locking Plate Application in the Distal Radius

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INTRODUCTION:
While volar locking plate fixation of distal radius fracture is effective, flexor tendons irritation caused by distally placed implants (Figure 1) are increasingly reported1. Extensor tendon rupture resulted from screws penetrating dorsal cortex (Figure 2) can also occur2,3; as accurate screw length measurement is often impossible due to the comminution of the dorsal cortex and determining screw length by lateral radiograph is also unreliable.

- Watershed line is a line marking the most volar aspect of the volar margin of the radius, which is distal to the pronator quadratus line and is covered by the volar capsule4.

Currently there exist few reports on the ‘watershed’ line (volar aspect distal to pronator fossa) as the distal limit of implant and no reference for optimum screw length. Nevertheless, related anatomical data come from Caucasian studies; there is lack of available data to support production of Asian-fit designs. In order to maximize the treatment effect of volar locking plates on Asians’ distal radius fractures with minimal complications, anthropometric data from Asians’ radius5,6,7 should be collected for production of proper Asian-fit implants. So, a study on morphology Asian radius should be conducted.

This study aims at 1) defining the anatomical location of watershed line 2) determining optimal screw length for different parts of distal radius.

MATERIALS & METHODS:
CT scans for twelve pairs of Asian cadaveric forearms were obtained. The watershed line was determined on serial sagittal cuts by4, the most prominent point on the volar aspect and its distance from the joint line was measured (Figure 3a). Eight quadrants arranged in 2 rows from radial to ulnar aspect (A to D distal, E to H proximal) where screw lengths were determined by computer assisted measurements. Fifteen degrees distally angulated lines were drawn to determine the screw length (Figure 3b).

RESULTS:
Watershed line was 13.78mm (SD=2.01) proximal to styloid process; 5.49mm (SD=1.14) from joint line across coronal midline; and 3.38mm (SD=1.40) from joint line on the medial region.

Optimal screw length determined at various quadrants were A) 15.40mm (SD=2.29) B) 19.61mm (SD=2.51) C) 20.80mm (SD=2.70) D) 20.04mm (SD=3.39) E) 13.29mm (SD=2.72) F) 18.04mm (SD=2.57) G) 18.77mm (SD=3.19) and H) 17.40mm (SD=3.63).

CONCLUSION:
Volar plates should not go beyond the reported watershed line for the Asian population. Screw length should be based on a reference from CT data instead of measurement, with attention over the radial and proximal aspect where screw lengths are shorter.

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REFERENCES: