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3D-Navigation Guided Minimally Invasive Percutaneous Fixation (MIS) for Pelvic-acetabular Fracture

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Introduction

Traditional open reduction internal fixation (ORIF) of pelvic-acetabular fracture carries relatively high surgical morbidities in terms of surgical exposure and blood loss. 3D-navigation guided pelvic-acetabular MIS was recently advocated to tackle the problems. It has been developing in our center since October 2015.

Objectives

We adopted this technique aiming at reducing surgical exposure, limiting intra-operative blood loss and radiation exposure without jeopardizing fixation quality and patient safety.

Methodology

All patients with pelvic-acetabular fractures indicated for surgery would receive CT pelvis, in which the DICOM data would be imported to Stryker NAV3i-Navigation System for pre-operative screw planning in order to achieve stable fixation and safe execution. Intra-operatively the system was connected to SIEMENS Arcadis-Orbic 3D C-arm and intra-operative CT was performed for calibration and fusion to pre-operative CT so as to execute screw insertion according to pre-operative planning. Feasibility of MIS in displaced fractures can also be assessed. Fracture reduction followed by repeating CT may be necessary in order to make definitive MIS feasible on displaced fracture under 3D-navigation guidance. The pre-operative workflow was also smoothly incorporated into our 3-in-1 pelvic damage control protocol for exsanguinating pelvic fracture which provided opportunities for fracture reduction if necessary during removal of pelvic packing.

Result

From October 2015 to October 2016, 49 consecutive pelvic-acetabular fractures with different complexity indicated for surgery admitted to our center were reviewed. Three cases (6%) required ORIF due to pubic symphysis diastasis or posterior acetabular wall fracture. 38 fractures (78%) were fixed using 3D-navigation MIS. The average

age was 51.6; 79% had trauma activation; 42% had received 3-in-1 protocol; the average Injury Severity Score was 21.8; 58% had received close or open reduction. 143 screws (including 59 sacro-iliac, 45 retrograde anterior-column, 34 supra-acetabular, three antegrade posterior-column and two sub-cristal screws) were navigated. The average entry and tip deviation between planned and executed screws measured in navigation computer were only 1.91mm and 1.94mm respectively, all of which were within the safe zones of pelvic anatomy. The average operative time and intra-operative blood loss were 141mins and 178ml respectively, which were much reduced compared with tradition ORIF. There was no surgical complication.
In conclusion, 3D-navigation MIS in conjunction with pre-operative planning and appropriate fracture reduction allowed definitive fixation for simple and complex pelvic-acetabular fractures.