Cortical Bone Trajectory Screw Fixation of Lumbar Spine in Adult Patients with Degenerative and Traumatic Spine Disorders

A Systematic Review/Meta-Analysis

Submitted For Partial Fulfillment of Master Degree in Orthopedic Surgery

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List of Abbreviations

Abb.	Full term
ANOVA	*Analysis of Variance*
AP	*Anterior/Posterior*
CBT	*Cortical Bone Trajectory*
CI	*Confidence Interval*
DF	*Degree of Freedom*
HS	*Highly Significant*
II	*Image Intensifier*
IQR	*Inter-Quartile Range*
MeSH	*Medical Subject's Headings*
NS	*Non-Significant*
ODI	*Oswestry Disability Index*
PRISMA	*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*
PS	*Pedicle Screw*
RD	*Risk Difference*
RR	*Risk Ratio*
S	*Significant*
SAE	*Serious Adverse Event*
SE	*Standard Error*
SMD	*Standard Mean Difference*
TT	*Traditional Trajectory*
VAS	*Visual Analogue Scale*

Abstract

Background: the CBT for placing lumbar pedicle screws is a technique used to improve fixation during instrumented fusion of the lumbar spine. In comparison with traditional trajectory (TT) for pedicle screws, CBT screws (otherwise known as pars screws or cortical screws) have a more medial starting point and are aimed in a medial to lateral, caudal to cranial direction. First reported in 2009 as a method to increase the purchase of lumbar pedicle screws within bone.

Aim of the Work: to perform a systematic review and meta-analysis to determine whether traditional Pedicles Screw Fixation (PS Fx) or Cortical Bone Trajectory Screw Fixation (CBT Fx); has been successful for the treatment and fixation of lumbar spine in adult patients with degenerative and traumatic spine disorders; and to compare the 2 techniques to identify risk factor for unfavorable outcome through the recent researches about that issue.

Methodology: this review was done using standard methodology outlined in the Cochrane Handbook and reported the findings in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement guidelines.

Results: meta-analysis study showed that;

1. Successful fusion rate in fixed and random-effects models were (92.24% respectively); in SP group.
2. Successful fusion rate in fixed and random-effects models were (92.44% respectively); in CBT group.
3. Fixed and random-effects models showed non-significant difference in successful fusion rate; between the 2 groups of studies ($p > 0.05$).

We calculated safety for each technique through post-operative (failed fusion rate).

Conclusion: Based on result of previous meta-analysis and although there were insignificant p-values in the most of the comparative items but the CBT showed lower average of intraoperative blood loss, operation time and higher average of decrease in VAS & increase in ODI, slightly higher fusion rate in comparison with PS.

Keywords: *Cortical Bone Trajectory - Lumbar Spine - Degenerative and Traumatic Spine Disorders - Screw Fixation*

INTRODUCTION

Many surgeons found difficulties and obstacles in fixation of lumbar spines in very old patients and osteoporotic patients, that's due to failure rates in these patients mostly due to engagement of the pedicle screws used in instrumentation with osteoporotic trabecular bone rather than cortical bone, which in general thought that cortical bone is much more tough than the trabecular bone.

And so scientists storm ideas about methods and techniques to increase purchase of cortical bone during fixation of lumbar spines, one of these is using another trajectory to increase the cortical bone purchase, theoretically that would decrease failure in instrumentation, and that is called cortical bone trajectory screw (CBT). But is it practically feasible for fixation of lumbar spine in those patients or is it inferiorly compared with the traditionally known pedicle screw.

AIM OF THE WORK

The Aim of this work is to assess the feasibility of the CBT screw fixation for lumbar spine as an alternative of the traditional pedicle screw for fixation and/or interbody fusion, through carrying out a meta analysis and systematic review of the previous literatures discussing the new technique.

REVIEW OF LITERATURES

Placement of the pedicle screw

A) *Kanter et al. (2008): minimally invasive spine surgery.* [1]

Pedicle screw (P.S) instrumentation enables a rigid construct to promote stability and fusion for numerous spinal pathologies including: trauma, tumours, deformity and degenerative disease. The safety of traditional open techniques for pedicle screw placement has been well documented. [1, 2]

First of all we have to review the known pedicle screw technique which was described in the a literature, just for a hint about the starting safe point and the direction and angles of the trajectory, not to be included in the meta analysis later.

Placement of pedicle screws technique:

The technique described here uses intra-operative radiography (image intensifier [II]) (fig 1). Possible use of intra-operative CT-based stereotactic guidance for pedicle screw placement; however, there is a greater degree of accuracy with the use of II for pedicle cannulation. For small thoracic pedicles, use of image intensified for enhanced accuracy with this technique.[1, 2]