

가

. *

. *

<	>
:	,
:	.
52	Routt
(sacral alar slope)	ICD(iliac cortical density)
(inter-ICD line)	(anterior), (coplanar),
(posterior)	6.5mm
.	가 가 가
McNemar χ^2 -test	Cochran Q-test
5 (9%)	(p<0.05).
47 18 (38.2%)	5 4 (80%) ,
가 (P<0.05).	가 16 , 가 25 , 가 11
15 (93.7%)	(P<0.05).
:	Routt 가 . ICD
가	가
:	,

:

67가 70,

TEL : +82-2-760-5130, 5131

FAX : +82-2-762-3985

E-mail : jongkeon@mm.ewha.ac.kr

*

2001

2)

1

(percutaneous iliosacral density) (ICD, iliac cortical (anterior), (coplanar), (Fig 2.-A, B, C).

screw fixation) (malposition) 12,13,14,16) Routt 15) (posterior)

가

가

3)

6.5mm

(Fig 3-A,B).

4)

1. 1995 1 2001 6 SAS (SAS version 6.12) McNemar χ^2 -test

91 Outlet view가

39 52 SAS P<0.05 Cochran Q-test 가

2.

1)

Routt^{14,15,16} 2 1 가 1)

가

52 5 (9%)

5 4 (80%)

47

(Fig1.) 18(38.2%) 가

(P<0.05).

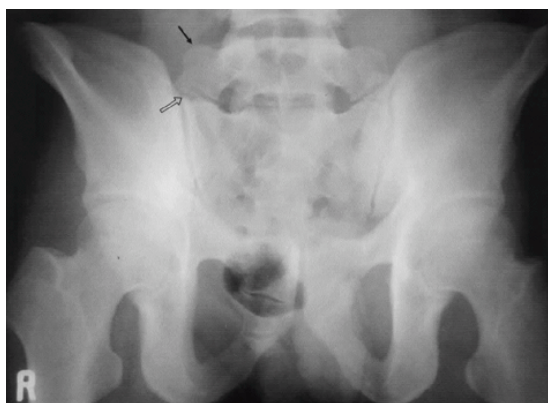


Fig. 1 : Plain pelvic outlet image of sacral dysmorphism. The solid arrow indicates the prominent mammillary process. The open arrow indicates the articulation between transverse process and the mammillary process.



Fig. 2 : Three types of alar slope classified on the base of inter-ICD(Iliac Cortical Density) line. **2A.** coplanar;the alar slope(arrow) is coplanar relative to the inter-ICD line,

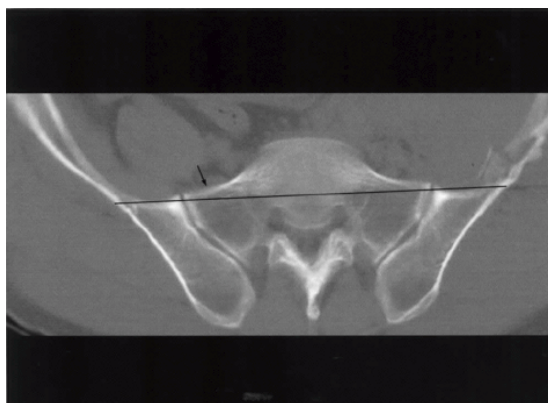


Fig 2-B : Anterior;the alar slope(arrow) is anterior relative to the inter-ICD line,



Fig 2-C : Posterior;the alar slope(arrow) is posterior relative to the inter-ICD line

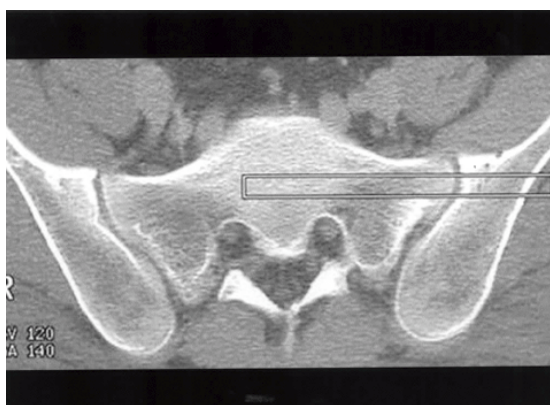


Fig. 3 : Safe zone for transverse iliosacral 6.5mm screw on CT image. The square represents the 6.5mm screw. **3A.** This CT image shows the wide safe zone.

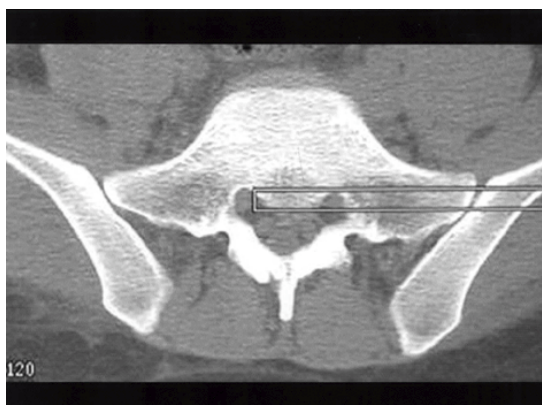


Fig 3-B : The safe zone was judged as narrow because the square violates the sacral foramen.

2) 가 16 , 가 25 , 15) .

가 11 . 16 15 (93.7%)

25 3 (12%), 5 (9%) Routt 35%

11 1 (9%) 가 ICD 가 Routt

(P<0.05). 가 (80%) 가 (5

)가

가 (ICD) (inter-ICD line)

, , , 가

, 가 93.7%

3,9,10,11,14,17)

2,5,6,15,18,19)

, 12,13,14,16)

2,15,19)

1,7,8,12,18) 가 가

. 가 , 가

, ,

. 3

2,4,19)

. 가

가 2,6,15)

Routt 가

가 가 가 가

30-40%
 Routt
 9%
 Routt
 가
 가
 ICD
 (inter-ICD line)
 가

REFERENCES

- 1) **Blake-Toker AM, Hawkins L, and Nadalo L et al:** CT guided percutaneous fixation of sacroiliac fractures in trauma patients.. J Trauma, 51-6: 1117-1121, 2001.
- 2) **Carlson DA, Scheid DK, Maar DC, Baele JR and Kaehr DM:** Safe placement of S1 and S2 Iliosacral screws: the " vestibule " concept. J Orthop Trauma, 14-4: 264-269, 2000.
- 3) **Comstock CP, Meulen MCH and Goodman SB:** Biomechanical comparison of posterior internal fixation techniques for unstable pelvic fractures. J Orthop Trauma, 10-8: 517-529, 1996.
- 4) **Day CS, Prayson MJ, Shuler TE, Tower J and Gruen GS:** Transsacral versus modified pelvic landmarks for percutaneous iliosacral screw placement: a computed tomographic analysis and cadaveric study. Am J Orthop, 29: 16-21, 2000.
- 5) **Ebraheim NA, Cooms RJ, Hoeflinger MJ and Jackson WT:** A pitfall of radiologic evaluation of sacroiliac joint screw positioning. Orthopedics, 16-5: 616-618, 1993.
- 6) **Ebraheim NA, Xu R, Biyani A and Nadaud MC:** Morphologic considerations of the first sacral pedicle for iliosacral screw placement. Spine, 22(8): 841-846, 1997.
- 7) **Gautier E, Bachler R, Heini P and Nolte LP:** Accuracy of computer-guided screw fixation of the sacroiliac joint. Clin Orthop, 393: 310-317, 2001.
- 8) **Jacob AL, Messmer P, and Stock KW et al:** Posterior pelvic ring fractures: Closed reduction and percutaneous CT-guided sacroiliac screw fixation. Cardiovasc Interv Radiol, 20: 285-294, 1997.
- 9) **Keating JF, Werier J, Blachut P, Broekhuysen H, Meek RN and O'Brien PJ:** Early Fixation of the vertically unstable pelvis: the role of iliosacral screw fixation of the posterior lesion. J Orthop Trauma, 13-2: 107-113, 1999.
- 10) **Kim JJ, Jeong YG, Chang JS, Kim KY and Baek SK:** Percutaneous iliosacral fixation in unstable pelvic ring injury. J Korean Orthop Assoc, 34: 1087-1092, 1999.
- 11) **Kregor PJ and Routt ML:** Unstable pelvic ring disruptions in unstable patients. Injury, 30-2: 19-28, 1999.
- 12) **Nelson DW and Duwelius PJ:** CT-guided fixation of sacral fractures and sacroiliac joint disruption. Radiology 180-2: 527-532, 1991.
- 13) **Pattee GA, Bohlman HH and McAfee PC:** Compression of sacral nerve as a complication of screw fixation of the sacro-iliac joint.: a case report. J Bone Joint Surg Am, 68: 769-771, 1986.
- 14) **Routt MLC, Nork SE and Mills WJ:** Percutaneous fixation of pelvic ring disruptions. Clin Orthop, 375: 15-29, 2000.
- 15) **Routt MLC, Simonian PT, Agnew SG and Mann FA:** Radiographic recognition of the sacral alar slope for optimal placement of iliosacral screws: a cadaveric and clinical study. J Orthop Trauma, 10-3: 171-177, 1996.
- 16) **Routt MLC, Simonian PT and Mills WJ:** **Iliosacral screw fixation** : early complications of the percutaneous technique. J Orthop Trauma, 11-8: 584-589, 1997.
- 17) **Tomlinson JL, Cook JL, Payne JT, Anderson CC and Johnson JC:** Closed reduction and lag screw fixation of sacroiliac luxations fractures. Vet Surg, 28-3: 188-193, 1999.
- 18) **Tonetti J, Carrat L, Lavalle S, Pittet L, Merloz P and Chirossel JP:** Percutaneous iliosacral screw placement using image guided techniques. Clin Orthop, 354: 103-110, 1998.
- 19) **Xu R, Ebraheim NA, Robke J and Yeasting RA:** Radiologic evaluation of screw placement.. Spine, 21-5: 582-588, 1996.

Abstract

Radiologic Evaluation for the Safe Zone of Percutaneous Iliosacral Screw Fixation

Jong-Keon Oh, M.D., *Su-Young Bae, M.D., Jong-Oh Kim, M.D.,
Kwon-Jae Roh, M.D., Jeong-Joon Lee, M.D. Sang-Yeol, Chang, M.D.

*Department of Orthopaedic Surgery, College of Medicine, Ewha Womans University,
Seoul, Korea*

**Department of Orthopaedic Surgery, National Medical Center, Seoul, Korea*

Purpose : To evaluate the correlation of the safe zone of percutaneous iliosacral screw fixation with sacral dysmorphism and sacral alar slope variation.

Materials and Methods : We studied the plain radiographs and the pelvic bone CT images of 52 patients. We reviewed each cases in terms of Routt 's dysmorphism and sacral alar slope variation (anterior, coplanar and posterior to inter-ICD line). We divided each cases into narrow and wide groups by the width of safe zone for the transverse 6.5mm cannulated cancellous screw. The data were analysed by McNemar χ^2 -test and Cochran Q-test ($p < 0.05$).

Results : Typical sacral dysmorphism was found in five cases (9%). Four cases with dysmorphism (80%) and eighteen non-dysmorphic cases (38.2%) revealed narrow safe zones. The sacral slopes were anterior in 16 cases, coplanar in 25 cases, and posterior in 11 cases. The safe zone was significantly narrow in the group with anterior slope variation.

Conclusion : We could not found definite correlation between sacral dysmorphism and a narrow safe zone because the incidence of dysmorphism was too low in our study which differed from Routt 's report. An anterior sacral alar slope on CT can be a significant risk indicator for potential narrow safe zone and the risk of screw malposition.

Key Words : Sacrum, Iliosacral screw fixation, Safe zone, Sacral dysmorphism, Sacral alar slope

Address reprint requests to _____

Ewha Womans University Dongdaemun Hospital
170 Chongro 6-ka, Chongro-ku, Seoul 110-126
TEL : +82-2-760-5130, 5131
FAX : +82-2-762-3985
E-mail : jongkeon@mm.ewha.ac.kr