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REVIEW ARTICLE

COMPARATIVE ANALYSIS OF POSTERIOR LUMBAR INTERPEDICULAR SCREW FIXATION USING X RAY VERSUS NAVIGATION OR INTRAOPERATIVE CT SPINE

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ABSTRACT

PLIF or posterior lumbar interpedicular screw fixation in cases of spondylolisthesis is a routine procedure performed by the orthopedic and neurosurgeons. Use of X-ray, CT scan or Navigation system is employed commonly to achieve the goal with minimal neurodeficits. X-ray is the most common and benefit is the minimal radiation in the operating room. CT scan gives a detailed information of the anatomical features but simultaneously involves huge amount of radiations making operating staff vulnerable to radiation health hazards .Our analysis is of patients who underwent use of navigation, CT scan or only plain X-ray during the surgery. Results however did not find any promising results with use of high radiation in surgery outcomes.

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INTRODUCTION

Accuracy of screw placement in thoracic, lumbar or sacral spine with use of Xray, CT scan or navigation system is a practice among neurosurgeons. Radiation hazards remain a concern. Navigation caries no radiation risk but is seldom employed alone and is used with O arm at least. CT scan caries higher radiation risks than plain x-ray but accuracy of screw placement is compromised. A careful decision has to be taken to attain highest accuracy with minimal radiation hazards. Our study shows negligible difference in surgical outcome in patients where any of these techniques were used.

MATERIALS AND METHODS

In our study 56 patient operated in our hospital of posterior lumbar interpedicular screw fixation were analyzed. Most of our patients were subjected to interop C arm for interpedicular screw placement s. A small group of patients underwent use of x ray and navigation system brain lab. Another small group underwent use of interaop ct scan at the end of procedure to see any correction needed prior to wound closure. Our observations are as per the Table 1 attached.

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RESULTS

In total we operated 56 patients since 2003. 13 patients out of 56 underwent PLIF where a carbon cage was placed in disc space. Rest patients underwent placing of bone pieces lateral to the rods on bared bony cortical surfaces to achieve bony union, removed during decompression (Mummaneni *et al*., 2014). One patient underwent occipitocervical fusion for AAD using hartshill loop. One patient of D12 fracture underwent retroperitoneal approach for anterior fusion. Navigation was used in two cases only. 8 patients underwent use of interaop CT scan. Results indicate that the patients undergoing use of either x ray or CT scan did not show any additional advantage. Navigation also did not show additional advantage rather increased surgical time. However high dose of radiations were subjected to the patient with use of interaoperative CT. Use of whatever image guided modality intraoperatively is more of surgeon 's preference and good surgical skills are the key to good outcome & skilled use of probe prior to putting the screw avoids major neural damage by medial placement of screws. Two of our patients had superficial infection managed conservatively.

DISCUSSION

Reishagen C in 2015 described a hybrid technique where one side facetectomy was done and intervertebral cage was put and

Table 1. Comparative statistics of CT guided PLIF to standard PLIF

S. No.	IP No.	Age /sex	Diagnosis	Surgical procedure/Date	Complications	Follow up	CT /Xray guided
1	105203	47/f	L4/5 listhesis with stenosis	L4 to L5 PLF/2006	Nil	Till 2012 Doing well	X ray
2	442927	58 yr/f	L4 to S1 with stenosis	L4 to S1 PLF/2006	nil	Till 2008	X ray guided
3	575648	59 yr/male	L5/S1 listhesis with canal stenosis	L5 to S1 PLF /2008	nil	Till 2015	X ray guided
4	521409	55/f	L4/L5 listhesis	L4/5 PLF 2008	Developed sere post op pain required revision of one screw	Till 2012	X ray guided
5	604400	76yr/Male	L4/5 listhesis	L4 to l5 plf 2009	nil	Till 2009	X ray /navigation guided
6	562511	49yrs female	L4/5 listhesis in previously operated case	L4/L5 PLF 2009	nil	Till 2010	X ray guided
7	611266	71yrs/f	L4/5 listhesis	L4/5 PLF 2009	nil	Till 2014	X ray/navigation
8	608968	47yrs /f	L4/5 listhesis	L4/5 PLF 2009	nil	Till 2010	X ray
9	630972	77yrs/f	L4/5 listhesis	L4/5 PLF 2009	nil	Till 2010	X ray
10	52530	62 yrs/m	L4/5 listhesis	L4/5 PLF 2009	nil	Till 2010	X ray
11	646361	73 yrs/m	L3 to L5 listhesis	L3 to L5 PLF 2010	nil	Till 2011	X ray
12	653360	59 yrs /m	L3/4 listhesis	L3 to l4 PLIF	nil	Till 7 mths	X ray
13	647138	60 yrs/f	L4/5 listhesis	L4/5 PLF 2010	nil	Lost to follow up	X ray
14	552191	73 yrs /m	D12 fracture	D11 to l1 anterior corpectomy and plating 2010	nil	Lost to follow up	X ray
15	656942	58 yrs/f	L3/4 listhesis	L3 to l4 PLF 2010	nil	Till 2011	X ray
16	566382	48 yrs /f	L5/S1 listhesis	L5 to S1 PLF 2010	nil	Till 2011	X ray
17	634343	62 yrs/m	L2 to l5 metastatic hepatocellular ca	Decompression with with L2 to L5 fixation 2011	Wound discharge	4 mths	X ray
18	663423	47 yrs /f	L4/5 listhesis	L4/5 plif with banana cage 2011	nil	4 mths	X ray
19	639218	54 yrs/f	L3/4 listhesis	L3 to l4 PLF 2011	nil	4 mth	X ray
20	569058	55 yrs/f	L3 to5 listhesis	L3 to l5 fixation	Slight wound discharge	Lost to follow up	X ray
21	550699	22 yr /m	AAD	Occipitocervical fusion with hartshill loop 2011	nil	6 mths	X ray
22	358369	36 yrs/m	L4/5 listhesis	L4/5 plf 2011	nil	1 yrs	X ray
23	323419	43yr/f	L4/5 listhesis	L4/5 plf 2011	nil	1 yr	X ray
24	683820	47yr/f	L4/5 listhesis	L4/5 plf 2012	nil	1 yr	X ray
25	466482	47 yr/f	L3 to L5 listhesis	L3 to L5 PLF 2012	nil	5 mths	X ray
26	719273	60 yrs/m	L4/5 listhesis	L4/5 plf 2012	nil	2 yrs	X ray
27	622481	63 yr/m	L4 to S1 listhesis	L4 to S1 PLF 2013	nil	1 yrs	Xray
28	682455	57 yrs/f	L4/5 listhesis	L4/5 plif 2013	nil	1 yr	X ray
29	350210	44 yrs/m	L3 to L5 listhesis	L3 to L5 PLF 2013	nil	1 yr	X ray
30	661587	27 yrs/m	L5/S1 listhesis	L5 /S1 PLIF with banana cage 2013	nil	2 mths	X ray
31	574981	70 yrs /m	L3/4 listhesis	L3/4 per cutaneous PLF 2013	nil	1 yr	X ray
32	755169	60 yrs /m	L4/5 listhesis	L4/5 plif percutenous with banana cage 2013	nil	1 yr	Intera op CT
33	384334	54 yrs/f	L2 to S1 listhesis	L2/ to s1 PLF 2013	nil	4 yrs	X-ray
34	587338	38 yrs/f	L4/5 listhesis	L4/5 plf 2013	nil	1 yr	X ray
35	699956	31 yrs male	L5/s1 listhesis	L5/S1 PLF 2014	nil	3 mths	X ray
36	521699	60 yrs/m	L3 to L5 listhesis	L3 to L5 PLF 2014	nil	1 mth	X ray
37	558656	77yrs/m	L4/5 listhesis	L4/5 PLF 2014	nil	1 mth	X ray
38	53929	69 yrs /m	L5/S1 listhesis	L5/S1 PLF 2014	nil	1yr	CT guided
39	791917	45 yrs/f	L4to S1 listhesis	L4 to S1 PLF 2014	nil	1 yr	CT guided
40	822688	64 yrs /m	L4/5 listhesis	L4/5 plif with banana cage 2014	nil	1 yr	CT guided
41	794572	55 yrs/f	L5/S1 listhesis	L5/S1 PLF 2015	nil	1 yr	CT guided
42	9992	45 yrs f	L5/S1 listhesis	L5/S1 PLIF 2015 with banana cage	nil	2 yr	CT guided
43	402 136	50 yrs /f	L5/S1 listhesis	L5/S1 PLF 2015	nil	1 yr	X ray

44	840886	59 yrs/m	L4/5 listhesis	L4/5 PLIF with banana cage 2015	Nil except superficial wound induration	1 yr	CT guided
45	44492	70yrs /m	L1/2 listhesis	L1/2 PLF 2015	Nil Slight wound gap conservatively improved	1 yr	X ray guided
46	601478	58 yrs /f	L4/5 listhesis	L4/5 PLIF with banana cage 2015	nil	1 yr	X ray guided
47	697227	55 yrs /f	L5/S1 listhesis	L5/S1 PLIF 2015 with banana cage	nil	1 yr 6 mths	X ray
48	870238	48 yrs/m	L5/S1 listhesis	L5/S1 PLF 2016	Intraop dural tear sutured primarily	3 mths	X ray
49	838786	52 yrs/f	L5/S1 listhesis	L5/S1 PLIF 2016 with banana cage	nil	8 mths	xray
50	678441	48 yrs /f	L4/5/s1 listhesis	L4 to S1 PLF 2016 with banana cage at l4/5	nil	1 yr	X ray
51	670860	52 yr/f	L3 to 5 listhesis	L3 to l5 PLF	nil	8 mths	X ray
52	558656	80 yrs/f	L4/5 listhesis	L4/5 PLF 2014	nil	1 mth	X ray
53	370502	55 yrs /f	L4/5listhesis	L4/5 PLIF with banana cage 2015	nil	1 yr	X ray
54	587338	42 yrs /f	L4/5 listhesis	L4/5 PLF 2014	nil	5 mths	Ct guided
55	24745	66 yrs/f	L5/S1 listhesis	L5/S1 PLF 2010	nil	1 yr	X ray
56	608968	47 yrs /m	L4/5 listhesis	L4/5 PLIF 2009 with banana cage	nil	1 yr	X ray

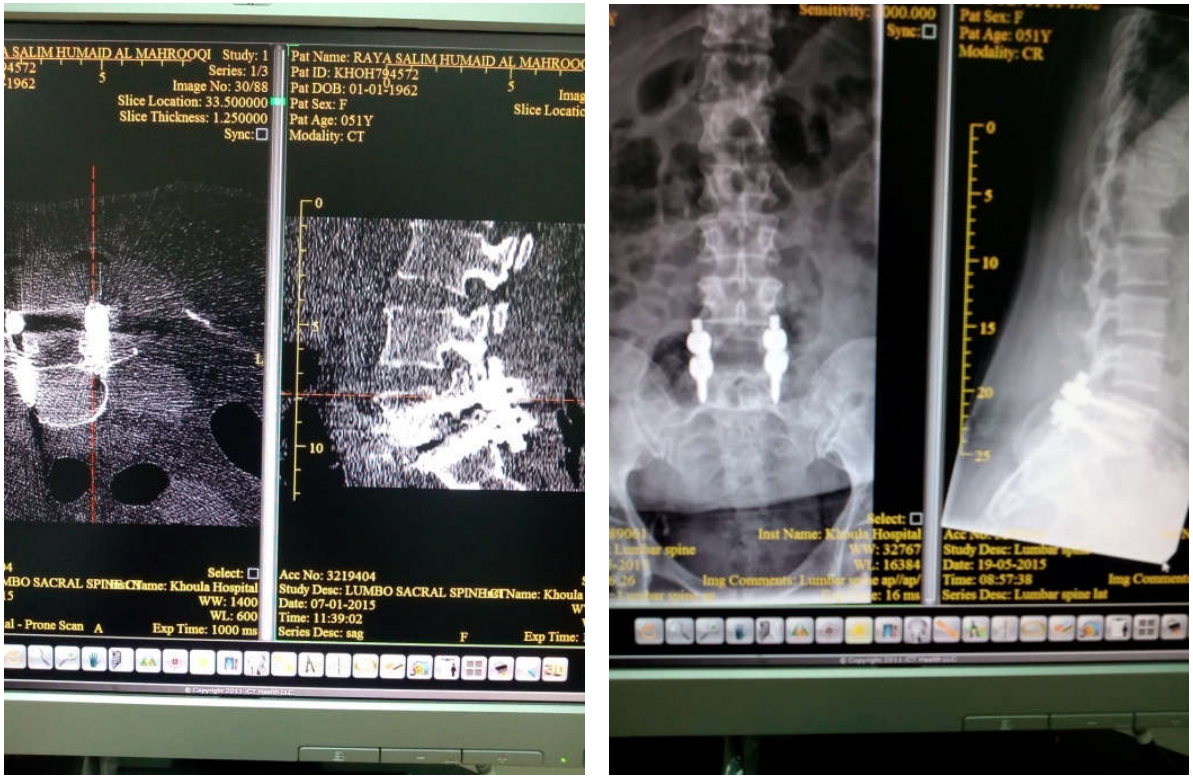


Fig.1. Use of interaop CT in PLF

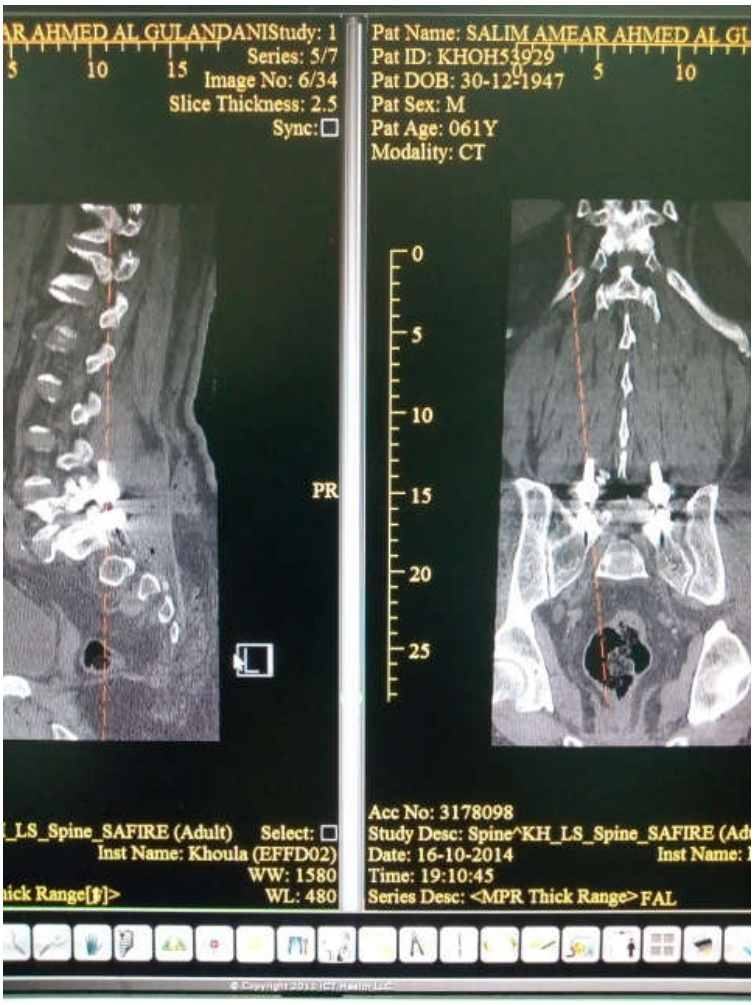
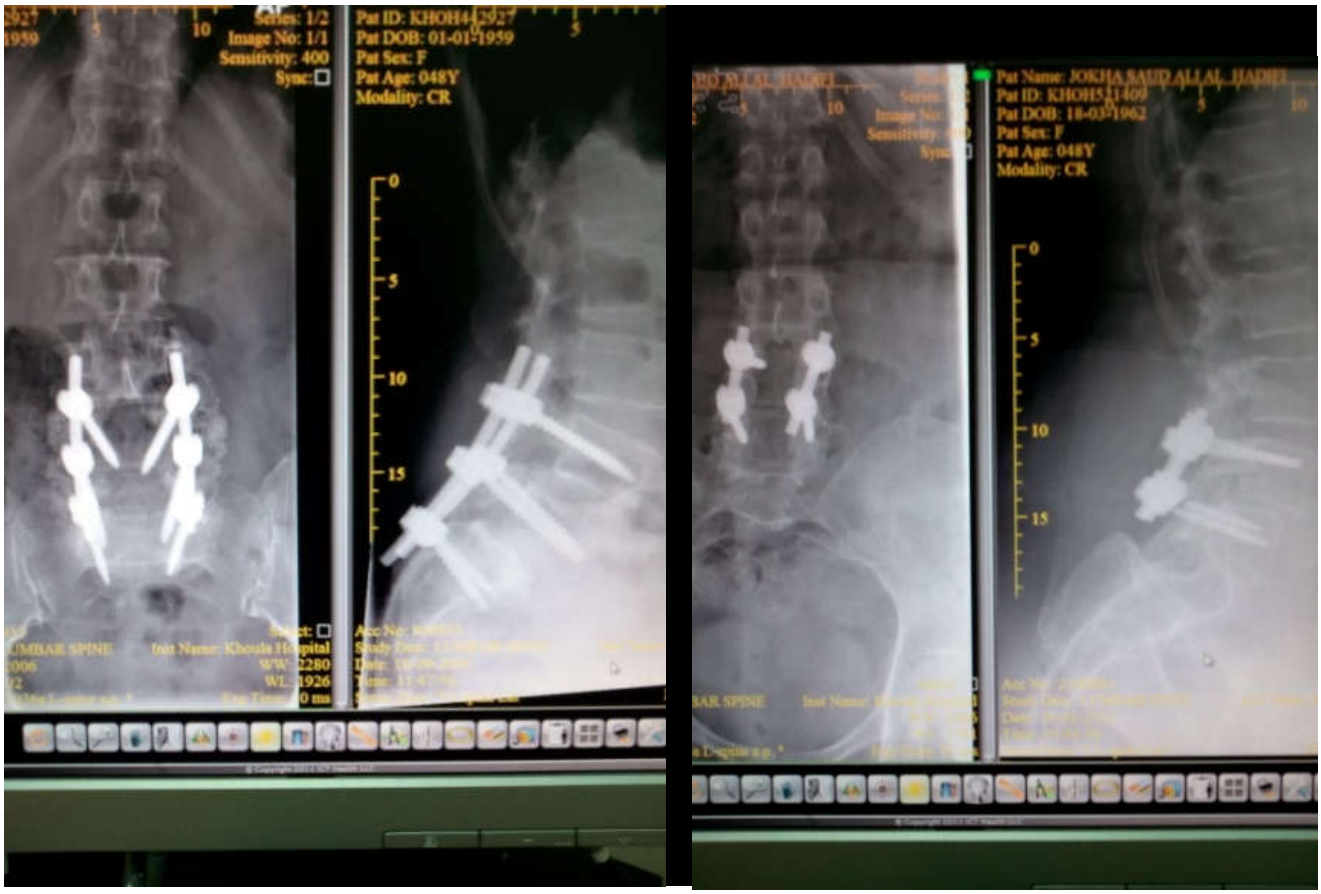


Fig.2. Use of interaop CT in another of our patient



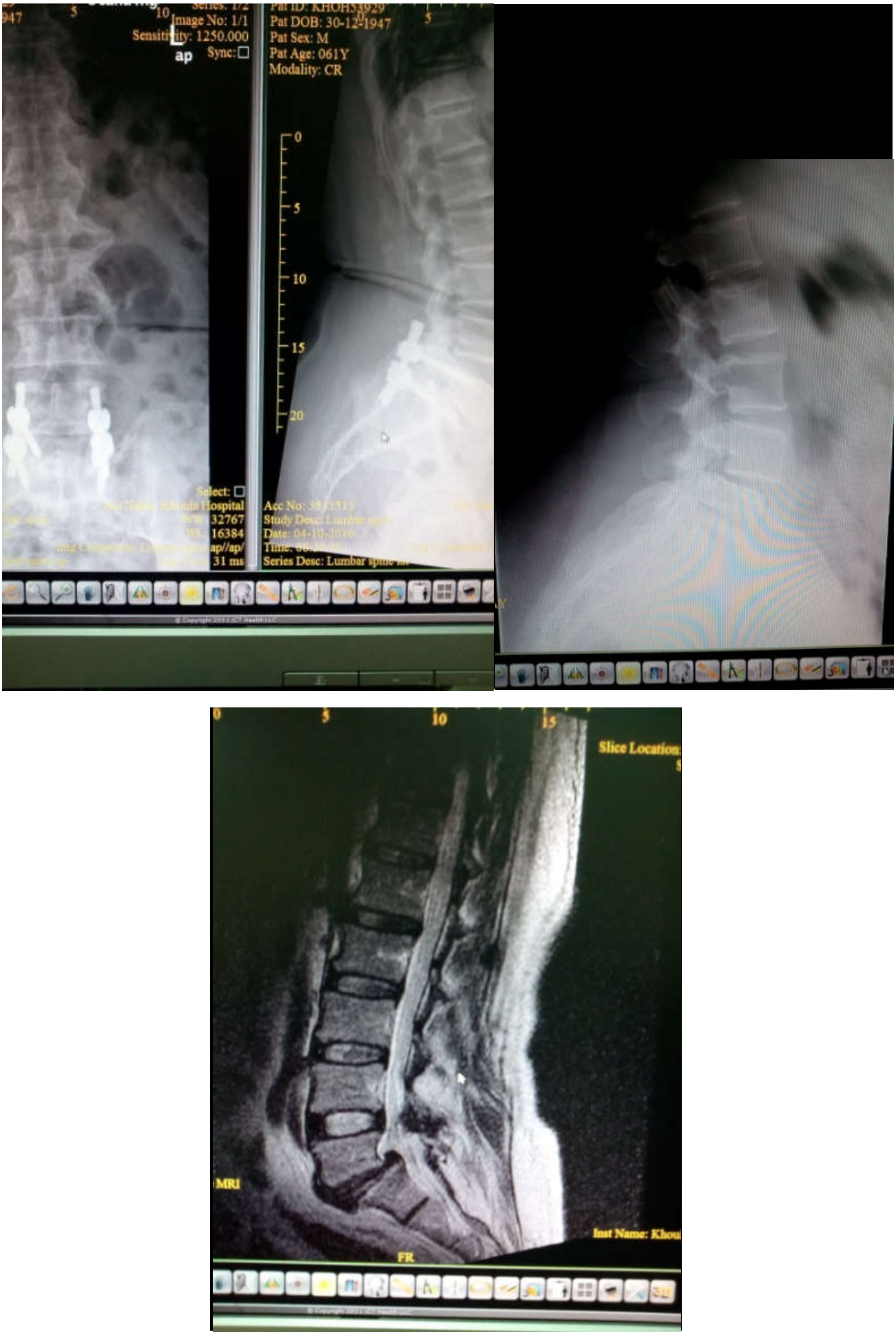


Fig. 3. Use of Xray alone in our patient s with pre op x ray and MRI images

pedicles screws were passed navigation guided and opposite side percutaneous pedicle screws were passed in degenerative spondylolisthesis (Reinshagen *et al*., 2015). Wang MY in 2014 described only lateral interbody fusion without any other instrumentation in cases of rostral adjacent segment degenerative stenosis (Wang *et al*., 2014). Rouben D in 2011 further emphasized via their study effectiveness of the the transforaminal interbody fusion via a minimal invasive technique (Rouben *et al*., 2011). Ebata in 2017 emphasized use of weekly Teriparatide administration in patients with osteoprosis undergoing PLIF procedures showing a better outcome (Ebata *et al*., 2017). Mummaneni in 2014 revealed that performing PLF alone without interbody fusion show almost same results if we perform PLIF (Mummaneni *et al*., 2014). However Macki M in 2015 emphasised if we do PLIF than PLF requirement of revision surgeries is minimised (Macki *et al*., 2015).

Conclusion

Our study further emphasizes that use of interaop CT scan or O arm is of immense help for correct placement of interpedicular screws causing minimal damage to the neural structures. However good surgical skills and use of x ray alone also give the same outcome as with the use of interaoperative ct scan. Risk of high dose radiations are avoided. Hence CT scan use should be restricted in specific complicated cases than in all cases as routine to give minimal radiation morbidity.

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