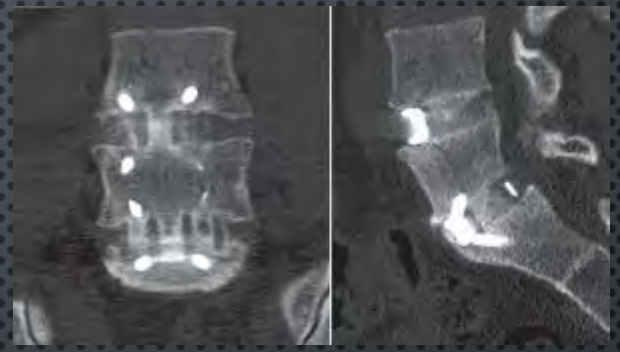
MIS DEFORMITY

Fred Mo, MD

Associate Professor Georgetown University

Dept of Orthopaedic Surgery

WHAT IS MIS?



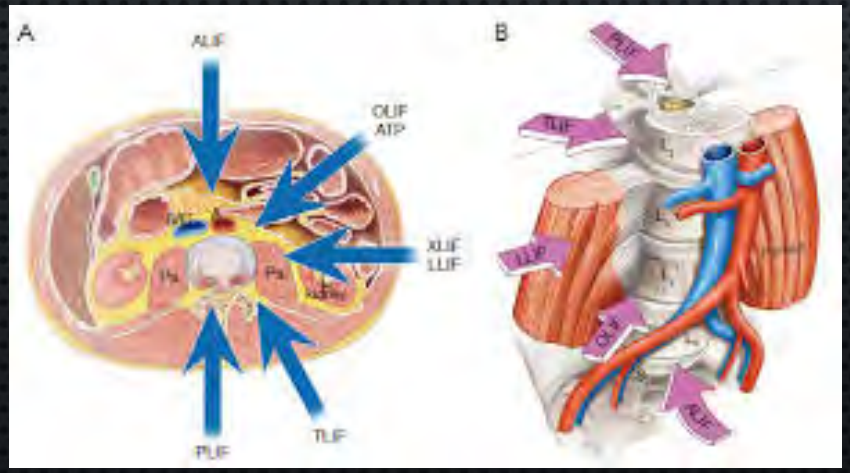


Figure 2. Photograph demonstrating minimally invasive spine surgery with percutaneous pedicle screw fixation.

- For open spinal deformity correction
  - major complication rate of 7.6%-50% has been reported
  - High blood loss
  - deep wound infection requiring reoperation 40-71%
- Minimally invasive surgery (MIS)
  - Decreased blood loss
  - Earlier mobilization

Bisson et al. Neurosurg Focus 2017

Complications in adult spinal deformity surgery: an analysis of minimally invasive, hybrid, and open surgical techniques

Juan S. Uribe, M.D.,[1] Armen R. Deukmedjian, M.D.,[1] Praveen V. Mummaneni, M.D.,[2] Kai-Ming G. Fu, M.D.,[3] Gregory M. Mundis Jr., M.D.,[4] David O. Okonkwo, M.D., Ph.D.,[5] Adam S. Kanter, M.D.,[5] Robert Eastlack, M.D.,[6] Michael Y. Wang, M.D.,[7] Neel Anand, M.D.,[8] Richard G. Fessler, M.D.,[9] Frank La Marca, M.D.,[10] Paul Park, M.D.,[10] Virginie Lafage, Ph.D.,[11] Vedat Deviren, M.D.,[12] Shay Bess, M.D.,[13] and Christopher I. Shaffrey, M.D.,[14] on behalf of the International Spine Study Group

TABLE 7: Complications among patients who underwent surgery for ASD*

Type of Complication	% of Patients				Chi-Square
	MIS	HYB	OPEN	Overall	
any complication	30.0	47.4	62.5	45.5	0.147
intraop complication	0.0	5.3	25.0	9.1	**0.027**
postop complication	30.0	47.4	50.0	41.8	0.401
major complication	30.0	47.4	62.5	45.5	0.147
minor complication	0.0	21.1	25.0	14.5	0.065
complication requiring surgery	15.0	15.8	18.8	16.4	0.952
DVT	0.0	15.8	0.0	5.5	**0.049**
PE	0.0	10.5	0.0	3.6	0.140
implant failure	10.0	5.3	6.3	7.3	0.836
neurological deficit	5.0	15.8	6.3	9.1	0.451
pneumonia	0.0	0.0	6.3	1.8	0.289
wound dehiscence	0.0	5.3	0.0	1.8	0.381
deep wound infection	0.0	0.0	0.0	0.0	1.000
proximal junctional kyphosis	5.0	10.5	6.3	7.3	0.788
other major complication	5.0	10.5	25.0	12.7	0.189

* The MIS group had the smallest and the OPEN group had the greatest percentage of patients with any, intraoperative, postoperative, major, and minor complications. Boldface indicates significant values.

REVISITING the ANTERIOR COLUMN

- MIS techniques can be performed alone, or in concert with, open procedures
- Circumferential MIS c(MISS)addresses 360 degree deformity correction with anterior column support

Park, S.W., Ko, M.J., Kim, Y.B. *et al.* Correction of marked sagittal deformity with circumferential minimally invasive surgery using oblique lateral interbody fusion in adult spinal deformity. *J Orthop Surg Res* **15,** 13 (2020)

Spine Deform. 2019 Mar;7(2):319-324. doi: 10.1016/j.jspd.2018.08.014.

The Prevalence of the Use of MIS Techniques in the Treatment of Adult Spinal Deformity (ASD) Amongst Members of the Scoliosis Research Society (SRS) in 2016.

Anand N[1], Agrawal A[2], Burger EL[3], Ferrero E[4], Fogelson JL[5], Kaito T[6], LaGrone MO[7], Le Huec JC[8], Lee JH[9], Mudiyam R[10], Sasao Y[11], Sembrano JN[12], Trobisch PD[13], Yang SH[14].

- ELECTRONIC SURVERY TO SRS MEMBERS
- 356 SURGEONS (61.3%) RESPONDED
- 157 (43.1%) REPORT MIS FOR TREATMENT OF ASD
- 67 (43.5%) STATED THAT MIS USAGE WAS 1-20% OF PRACTICE
- 11 (7.2%) UTILIZED MIS 81-100% OF THE TIME

World Neurosurg. 2016 Mar;87:55-60. doi: 10.1016/j.wneu.2015.12.024. Epub 2015 Dec 25.

Comparison of Complications and Clinical and Radiographic Outcomes Between Nonobese and Obese Patients with Adult Spinal Deformity Undergoing Minimally Invasive Surgery.

Park P[1], Wang MY[2], Nguyen S[3], Mundis GM Jr[3], La Marca F[4], Uribe JS[5], Anand N[6], Okonkwo DO[7], Kanter AS[7], Fessler R[8], Eastlack RK[9], Chou D[10], Deviren V[11], Nunley PD[12], Shaffrey CI[13], Mummaneni PV[10]; International Spine Study Group.

- Mean BMI was 24.6 nonobese and 35.0 obese (P < 0.001)
- Postoperative lumbar lordosis-pelvic incidence mismatch averaged 17.9° obese and 9.9° nonobese (P = 0.028)
- No difference in postoperative ODI scores between groups (P = 0.090). Similarly, both groups had decreased VAS scores for back and leg pain with no difference between groups postoperatively.
- Twenty (33.9%) nonobese patients versus 7 (38.9%) obese patients had complications (P = 0.452).

Neurosurg Focus. 2014 May;36(5):E13. doi: 10.3171/2014.3.FOCUS1424.

Comparison of radiographic results after minimally invasive, hybrid, and open surgery for adult spinal deformity: a multicenter study of 184 patients.

Haque RM[1], Mundis GM Jr, Ahmed Y, El Ahmadieh TY, Wang MY, Mummaneni PV, Uribe JS, Okonkwo DO, Eastlack RK, Anand N, Kanter AS, La Marca F, Akbarnia BA, Park P, Lafage V, Terran JS, Shaffrey CI, Klineberg E, Deviren V, Fessler RG; International Spine Study Group.

- 234 PATIENTS WITH ADULT SPINAL DEFORMITY
- MIS GROUP MAINTAINED A SIGNIFICANTLY SMALLER MEAN LUMBAR COBB ANGLE (13.1°) AFTER SURGERY COMPARED WITH THE OPEN GROUP (20.4°, P = 0.002

TABLE 5:
Summary of surgical data

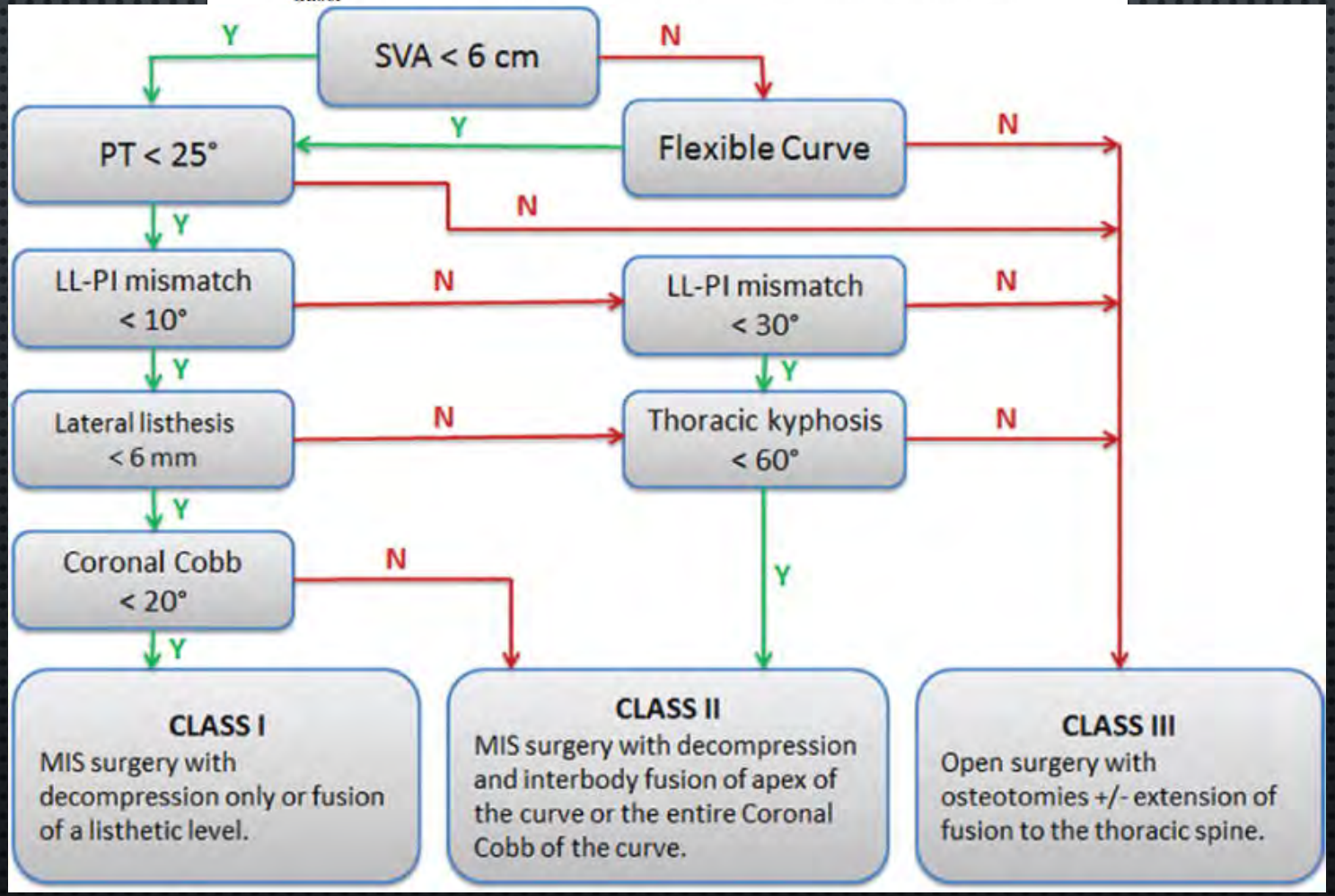
Surgical Variable	MIS	Hybrid	Open	p Value	Post Hoc
mean EBL ± SD (ml)	507 ± 841	2003 ± 1192	2109 ± 1744	<0.001 (ANOVA)	MIS < hybrid, open
mean OR time ± SD (min)	462 ± 177	710 ± 264	434 ± 147	<0.001 (ANOVA)	hybrid > MIS, open
transfusion %	23.8	63.6	85.3	<0.001 (chi-square)	
% major complications*	14	14	45	0.003 (chi-square)	

TABLE 5: Summary of surgical data

*Major complications are defined as:[6] "Patient required reoperation, death, blindness, cardiac arrest, deep venous thrombosis, pulmonary embolism, implant failure, neurological deficit, pneumonia, sepsis, stroke, vascular injury, visceral injury, wound dehiscence, deep wound infection, hematoma formation with reoperation and proximal junctional kyphosis with reoperation." EBL = estimated blood loss; OR = operating room.

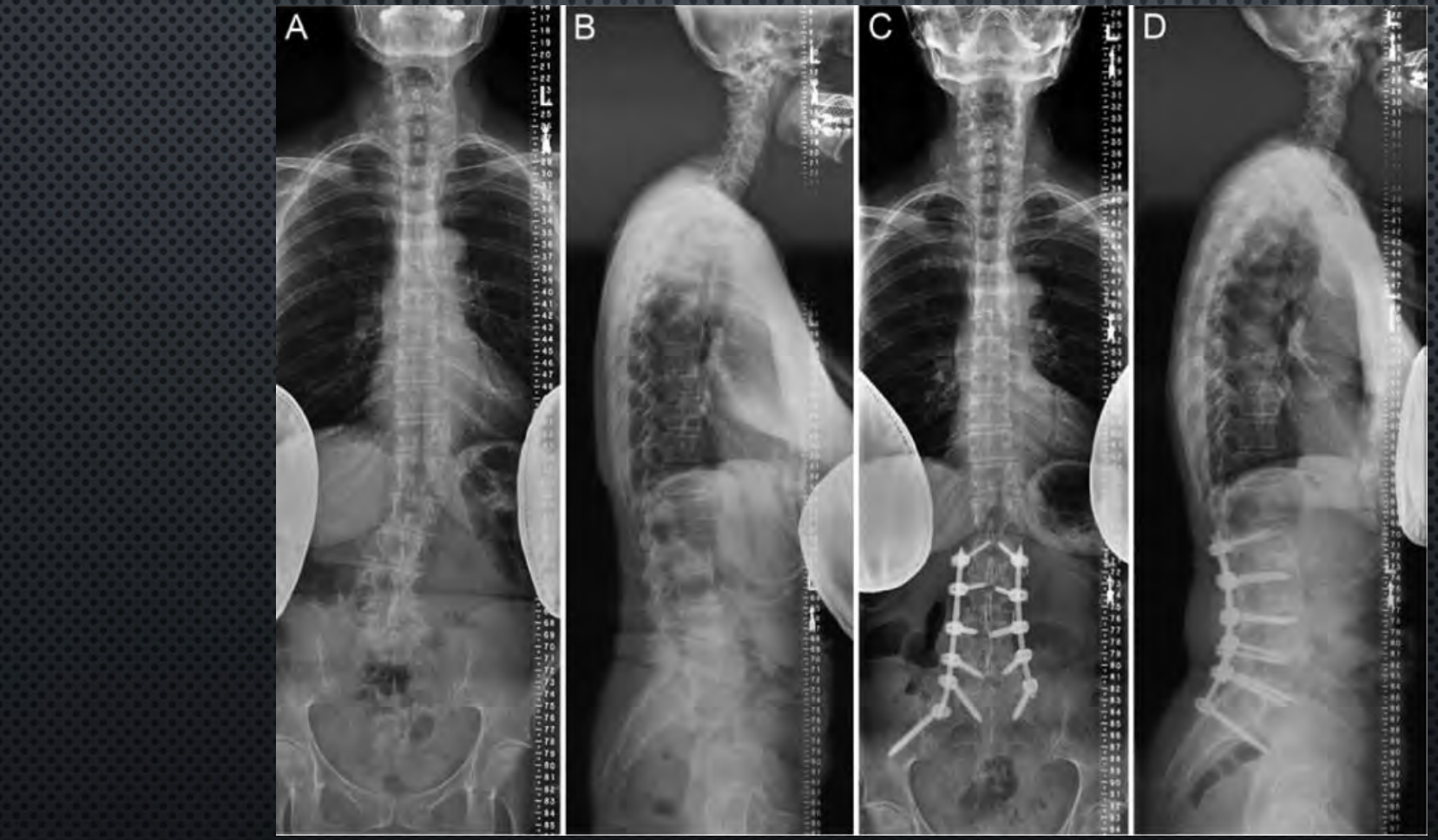
The minimally invasive spinal deformity surgery algorithm: a reproducible rational framework for decision making in minimally invasive spinal deformity surgery

Praveen V. Mummaneni, M.D.,[1] Christopher I. Shaffrey, M.D.,[2] Lawrence G. Lenke, M.D.,[3] Paul Park, M.D.,[4] Michael Y. Wang, M.D.,[5] Frank La Marca, M.D.,[4] Justin S. Smith, M.D.,[2] Gregory M. Mundis Jr., M.D.,[6] David O. Okonkwo, M.D., Ph.D.,[7] Bertrand Moal, M.S.,[8] Richard G. Fessler, M.D., Ph.D.,[9] Neel Anand, M.D.,[10] Juan S. Uribe, M.D.,[11] Adam S. Kanter, M.D.,[7] Behrooz Akbarnia, M.D.,[6] and Kai-Ming G. Fu, M.D.,[12] on behalf of the Minimally Invasive Surgery Section of the International Spine Study Group



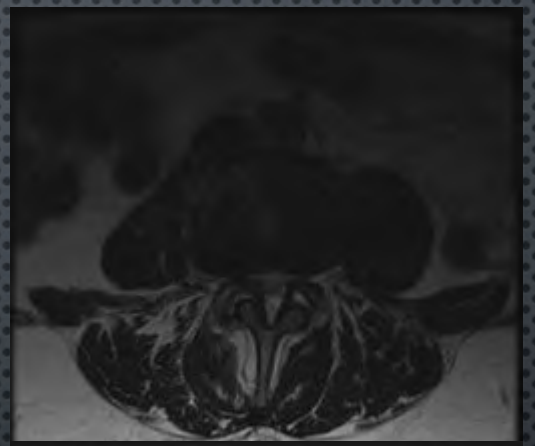
MUMMANENI ET AL JNS 2018

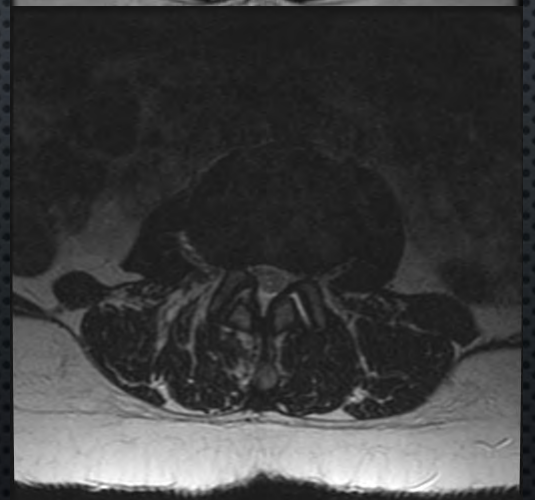
MISDEF CLASS II



MISDEF CLASS III

CASE JH






L


7467868
Dr, MO
06/14/1956
F
62
45
85 kVp
2.52 mA
2
OEC


L2-5 XLIF
7467868
Dr, MO
06/14/1956
F
1:34:16 PM
6
62
46
92 kVp
3.04 mA
1
OEC

7467868
MO, FRED
06/14/1956
F
36
58
90 kVp
4.00 mA
2
OEC


Standing
Study Time: 08:25:12
IM #: 1
SE #: 2
Zoom Factor: 0.27
PID: 7467868
Acc # 9078503
DOB: 14-Jun-1956
Age: 061Y
Sex: F
Standing
L

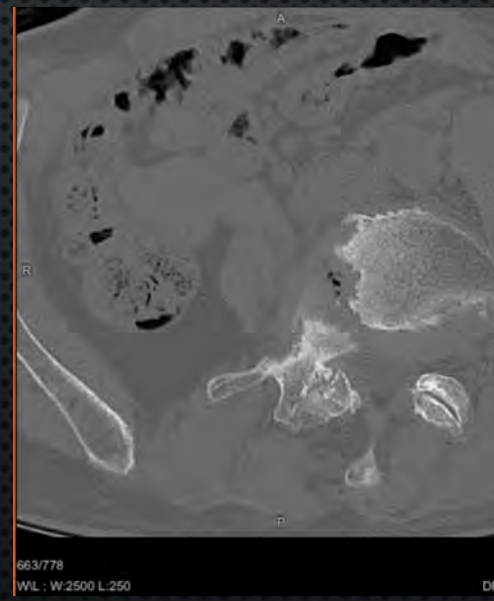
JR


R
D A R


LEFT


DOB: 18-Jan-1963
Age: 056Y
Sex: F
SE #: 1
Zoom Factor: 0.23
UPRIGHT
Study Desc: DIA OUTSIDE COMPARISON
Series Desc: L SP AP
ACQ Date: 03-14-2019
ACQ Time: 16:24:15
Ref Physician: Ashish G Shanbhag, MD
1/1
W/L : W:4096 L:2048
StatName: USER-PC
Inst: Insight Imaging Fairfax
L SP AP


Acc # 9809015
DOB: 18-Jan-1963
Age: 056Y
Sex: F
IM #: 1
SE #: 5
Zoom Factor: 0.22
UPRIGHT
Study Desc: DIA OUTSIDE COMPARISON
Series Desc: L SP LAT
ACQ Date: 03-14-2019
1/1
W/L : W:4096 L:2048


A
R
P
663/778
W/L : W:2500 L:250

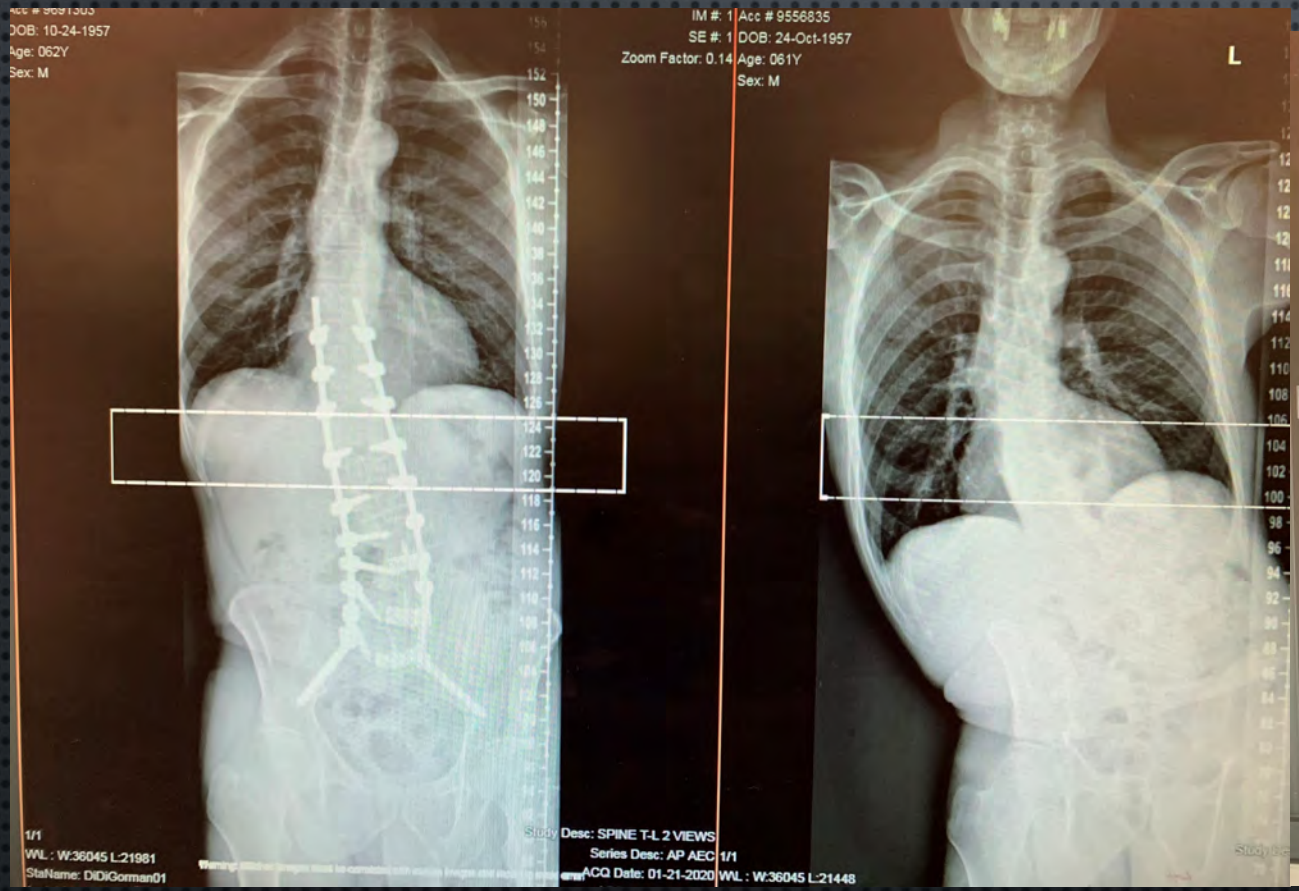

Age: 056Y
Zoom Factor: 0.17
Sex: F
Study Desc: ABDOMEN 1V


UPRTCHT
PID: 7842337
Acc # 9689465
DOB: 01-18-1963
Age:
Sex: F
Study Time: 15:41:12
IM #: 1
SE #: 1
Zoom Factor: 0.22
1: Lumbar spine ap
2: Lumbar spine lat
Study Desc: SPINE LUMBOSACRAL 2V 3V
Series Desc: Lumbar spine ap
ACQ Date:
ACQ Time:
Ref Physician: FRED F MO


PID: 7842337
Acc # 9689465
DOB: 01-18-1963
Age:
Sex: F
IM #: 1
SE #: 2
Zoom Factor: 0.22
Study Desc: SPINE LUMBOSACRAL 2V 3V
Series Desc: Lumbar spine lat
ACQ Date:
ACQ Time:
1/1

PATIENT GP


Age: 061Y
Sex: M
SL Thk: 3
IM Time: 16:13:26
Zoom Factor: 0.53
R
P
H
L
A
F
27/52
W\L : W:2500 L:250
ACQ Time: 16:13:26
IM Time: 16:13:26
IM Date: 07-18-2019
StaName: CTAWP75728
DFOV: 218
TILT: 0
kV: 130
mas: 152
th: 143.5


DOB: 10-24-1957
Age: 062Y
Sex: M
1/1
WL : W:36045 L:21981
StaName: DiDiGorman01
Study Desc: SPINE T-L 2 VIEWS
Series Desc: AP AEC
ACQ Date: 01-21-2020

IM #: 1
SE #: 1
Zoom Factor: 0.14
Acc # 9556835
DOB: 24-Oct-1957
Age: 061Y
Sex: M
L
1/1
WL : W:36045 L:21448

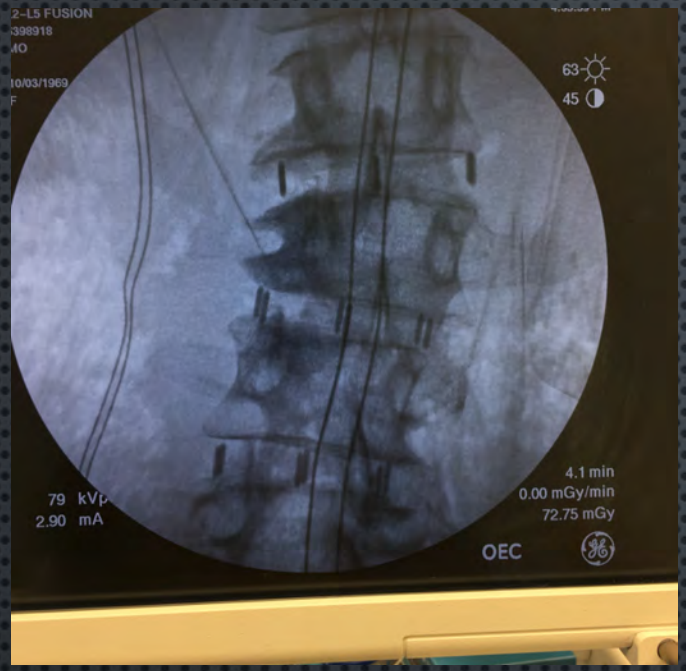

SE #: 6
Zoom Factor: 0.15
Age: 062Y
Sex: M
1/1
WL : W:36045 L:22941
StaName: DiDiGorman01
Inst: MGUH
Study Desc: SPINE T-L 2 VIEWS
Series Desc: Lateral AEC
ACQ Date: 01-21-2020
ACQ Time: 11:00:29
Ref Physician: FRED F MD


DOB: 24-Oct-1957
Age: 061Y
Sex: M
1/1
WL : W:36045 L:25340
StaName: DiDiGorman02
Inst: MGUH

SPINE T L 2V
09-20-2019 21:51:34
(7)
SPINE T-L 2 VIEWS
07-02-2019 09:56:00
(7)


TrigWin: 0
Zoom Factor: 0.80
3/15
ImFreq: 63.848863
W/L : W:1771 L:885
NOA/NEX: 3
Pos: HFS
TE: 43.44
16
15
21
5: SAG T1
6: COR STIR OPT.
7: O-Ax T2 STACK


Zoom Factor: 0.80
11/16
ImFreq: 63.848863
W/L : W:2860 L:1430
NOA/NEX: 2
Pos: HFS
TE: 108.256
Lat: 19
16
ET: 11


63
45
4.1 min
0.00 mGy/min
72.75 mGy
79 kVp
2.90 mA
OEC


MEDSTAR GEORGETOWN
06/08/2017
4:35:18 PM
64
45
78 kVp
2.84 mA
OEC


DOB: 03-Oct-1969
Age: 047Y
Sex: F
SE #: 1
Zoom Factor: 0.22


Acc # 9070457
DOB: 03-Oct-1969
Age: 047Y
Sex: F
IM #: 1
SE #: 2
Zoom Factor: 0.22
1/1

THANK YOU