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Increased Post-Operative Pain Following Minimally Invasive Total Knees

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Abstract

Minimally Invasive Surgery (MIS; <10cm) Total Knee Arthroplasties (TKAs) had increased pain at 6 week post-operatively over standard TKAs. All variables studied showed no difference in outcomes to 24 months.

Introduction: Our aim was to determine if MIS techniques improved post-operative outcomes when controlling for perioperative therapy protocols and pain management

Methods: Single surgeon series of 139 consecutive TKAs, 50 performed using MIS techniques and 89 through incisions. All data points collected were compared to all TKAs in registry to control for patient selection. All patients underwent the same pre and post operative management.

Results: 89 standard and 50 MIS TKAs were identified and compared to 19,956 TKAs in the registry. No significance difference was identified in age, pre-operative ambulatory support, and height between all 3 groups. The MIS group had a higher number of women and lower weight than both standard and registry patients. The study cohort's patients tended to have a lower range of motion and more pain than the registry. Operative time and blood loss were not significantly different between standard and MIS group but were both significantly lower than registry TKAs. At 6 weeks, the only significantly different variable was increased pain (p=0.019) in the MIS group. There were no significant differences at 3 months, 1 year, or 2 years between any group.

Conclusion: When controlling for peri-operative pain management and therapy, MIS surgery was associated with more pain than standard incision procedures. There seems to be no benefit to MIS (<10cm) techniques at longer follow up. We do not recommend the procedure over standard TKA surgery.

Introduction

Several papers on MIS TKA have reported improved clinical outcomes over standard approaches in the first 3 months after surgery,[1,6-9] shorter lengths of stay (LOS),[6,7] and no differences in radiographic alignment.[1-7,9] Kolisek et al reported on a multicenter study in which no difference in outcome was noted.[4] However, improvements in clinical scores were often seen along with simultaneous changes in post operative pain management protocols, physical therapy protocols, patient selection, and patient expectations10.Since our peri-operative pain management and physical therapy protocols were all in place prior to the inception of MIS surgery, and an average LOS for all patients at 3 days regardless of surgical technique, we were able to see if MIS TKA surgical technique was an independent variable associated with better clinical outcomes.

Materials and Methods

We conducted a retrospective analysis of a single surgeon (senior author SAB) series of patients that underwent standard TKAs and MIS TKAs. The series was comprised of 139 consecutive total knees, 50 performed using MIS techniques and 89 through standard incisions. MIS technique was defined as a skin incision of 10 cm or less and a mid-vastus incision of no greater than 1 cm. All patients underwent the same pre and post operative management. Pain, satisfaction, range of motion, and complications due to the surgeries were reviewed and compared.

Data Sources:

The KP Total Joint Replacement Registry is the second largest community based joint registry in the county with over 26,000 TKAs recorded since its conception. The registry provided us with the number of TKAs performed and all variables analyzed. Infections, DVTs, and PE are continuously monitored by the registry and validated quarterly by an orthopedic nurse according to established guidelines.

Inclusion and Exclusion Criteria:

All primary TKAs registered between April'01 and March'06. Revision procedures, conversion procedures, ORIFs, unicompartmental knee arthroplasties, and other procedures not identified as primary TKAs were excluded.

Statistical Analysis:

Pearson Chi-Square and Fisher's exact test were used to compare the categorical variables operative site, gender, complications, and categorical post-operative events reported between MIS patients and standard TKA patients. Mann-Whitney test was used to compare pre-operative and post-operative continuous variables such as age means, height, weight, flexion, extension, pain, and satisfaction (post-op only). The significance level was set at 0.05.

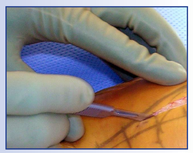
Minimally Invasive Surgical Technique:

Following routine prepping and draping, a 10 cm midline incision extending proximally from the tibial plateau was made. The medial arthrotomy was performed and extended no further than 1-2 cm into the VMO. The patella was sufficiently mobilized to allow it to be cut in extension using standard instrumentation (release patello-femoral ligament and debride fat pad). The patella was not everted and was protected with a metal disk. The distal femoral cuts were followed by the proximal tibial cut. Next are the femoral chamfer cuts, notch cut and tibial preparation. Closure included a re-approximation of the synovial lining of the suprapatellar pouch incorporated into a single running, absorbable, braded suture for the extensor mechanism

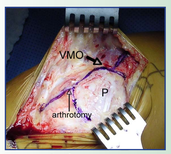
See pictures for details.

Standard Surgical Technique:

Similar to above, except that there are no restrictions on incision length or quadriceps incision. The average incision is 14-16 cm and the quadriceps incision is 4 cm. Further, the cut sequence differs in that the femur is completed first prior to cutting the tibia.



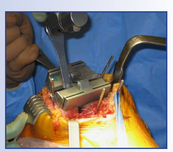
Skin



Arthrotomy

Patella

Distal Femur



Chamfer

Tibia

Wound

Results

89 and 50 MIS TKAs were identified and compared to 19,956 TKAs in the registry. No significant differences were found in age, pre-operative ambulatory support, and height between all 3 groups. The MIS group had a higher number of women and lower weight than both standard and registry patients. The study cohort's patients tended to have a pre-operative lower range of motion and more pain than the registry. Operative time and blood loss were not significantly different between standard and MIS group but were both significantly lower than registry TKAs. LOS was 3.2 days for both groups. *See Table 1 for pre-operative and intra-operative detail.*

6 Weeks:

Pain was the only variable found to be significantly different between the groups within 6 weeks of surgery (Table 2). MIS TKA recorded more pain (4.32 ± 2.8) than standard TKA (3.04 ±1.9), p=0.019. Stiffness was reported in 5.2% of the standards TKAs vs. 4.9% of MIS TKAs, p=1.00. 1.3% of the standard TKAs and 2.4% of the MIS TKAs planned a revision, p=1.00. Only 1 (2.4%) other medical complication was reported in the MIS group.

7-12 Weeks:

No statistically significant differences were found between the groups. 10.4% of the standard TKAs reported stiffness and 3.8% of the MIS TKAs, p=0.42. One (3.8%) MIS reported a revision planned. No other complications were reported.

11-13 Months and more than 23 months:

No statistically significant differences were found between the groups at either time interval. The only complication reported was a planned revision at 11-13 months post-operative for one MIS.

Infection, DVT, and PE Rates:

Detail in Table 3. The rate of superficial infection in MIS TKAs (4.0%) is higher than in the overall registry standard TKA population (0.2%), p=0.04. The MIS TKA group also has a higher rate of DVTs (4.0%) than the standard TKA population in the registry (0.3%), p=0.01. No differences were found between the rates of infections, DVTs, and PEs between the Sr. author's standard TKAs and the registry standard TKAs. No significance differences were found between the Sr. author's standard TKAs group and the MIS group.

Table 1. Standard Demographics, Pre-Operative Measurements & Intra-Operative Information

	MIS TKAs	Standard TKAs	Registry Standard TKAs
Total N	50	89	19,956
Gender (n, %)			
Males	9 (18.0%)	33 (38.4%)	6806 (36.0%)
Females	41 (82.0%)	53 (61.6%)	12109 (64.0%)
Age (mean, st dev)	67.04 (13.2)	69.22 (10.8)	67.8 (9.47)
Height, inches (mean, st dev)	65.5 (4.06)	66.4 (4.10)	65.8(4.22)
Weight, lbs (mean, st dev)	168 (38.5)	192 (37.9)	194 (44.0)
BMI, kg/m2 (mean, st dev)	27.4 (5.26)	30.7 (5.64)	31.7 (6.5)
Pain (mean, st dev)	5.88 (2.84)	6.05 (2.62)	7.18 (2.30)
Flexion, degrees (mean, st dev)	103 (19.3)	98.9 (18.9)	110.6 (13.8)
Extension, degrees (mean, st dev)	2.04 (7.37)	0.33 (4.18)	3.93 (6.90)
Use ambulatory support (n, %)	17 (39.5%)	23 (34.8%)	4768 (41.7%)
EBL, Mls (mean, st dev)	73.1 (140)	76.8 (132.6)	117.2(113.5)
Operative Time, Min (mean, st dev)	80.2 (28.7)	78.0 (27.6)	96.4 (33.5)

- Not all patients in the registry have pre-operative information. Gender is missing for 6.7% standard TKA patients, 5.2% registry patients. Use of ambulatory support is missing for 42.7% of registry cases, 25.8% standard TKAs and 14% for the MIS cases.

Table 2. Post-Operative Outcomes- @ 6 Weeks

	MIS TKAs N=41	Standard TKAs N=77	MIS TKA vs. Standard TKA P-Value	Registry Standard TKAs N=10908
Revision planned (n, %)	1 (2.4%)	1 (1.3%)	1.00	39 (0.4%)
Instability (n, %)	0	0	--	16 (0.1%)
Stiffness (n, %)	2 (4.9%)	4 (5.2%)	1.00	327 (3.0%)
PF pain (n, %)	0	0	--	14 (0.1%)
MUA (n, %)	0	1 (1.3%)	1.00	30 (0.3%)
Medical complications (n, %)	1 (2.4%)	0%	0.347	48 (0.4%)
Nerve palsy (n, %)	0	0	--	26 (0.2%)
Death (n, %)	0	0	--	2 (0.0%)
Dislocation (n, %)	0	0	--	2 (0.0%)
Use ambulatory support (n, %)	26 (63.4%)	56 (72.7%)	0.295	7935 (72.7%)
Pain (mean, std)	4.32 (±2.8)	3.04 (±1.9)	0.019*	3.59 (±2.3)
Satisfaction (mean, std)	8.59 (±2.0)	8.86 (±1.9)	0.559	8.98 (±1.7)
Flexion (mean, std)	94.3 (±17.2)	97.8 (±14.6)	0.351	98.5 (± 13.8)
Extension (mean, std)	4.73 (±7.6)	3.73 (±7.7)	0.268	4.08 (±6.02)

- MIS TKAs had higher pain than Sr. author's standard TKAs (p=0.019)

Table 3. Total Joint Registry Validated Complications

	MIS TKAs N=50	Standard TKAs N=89	Registry Standard TKAs N=19956
Infection	2 (4.0%)	2 (2.2%)	152 (0.8%)
Deep	0	1 (1.1%)	119 (0.6%)
Superficial	2 (4.0%) *	1 (1.1%)	33 (0.2%)
DVT	2 (4.0%) *	0	60 (0.3%)
PE	0	0	55 (0.3%)

*Rates are different from registry standard TKA rates

Discussion

Over the past several years, less invasive surgical techniques have been perfected with the goal of minimizing soft tissue trauma so as to improve patient outcomes. Alongside these techniques, improved peri-operative patient care has addressed everything from pre-operative teaching, pain management and aggressive physical therapy. Furthermore, the average age for total knee replacement continues to drop while anecdotally it appears that the disease acuity prior to total knee replacement is less than in years past. Thus, the total knee patient is better equipped than ever before to enjoy a quick return to activities of daily living. The question we were trying to address is whether it is necessary to have a very small incision to reap the benefits of less invasive surgery.

Our results were interesting and somewhat in contrast to our expectations. At 6 weeks we found a statistically significant increase in self reported pain (p=0.019) but no other change in variables. The increased pain may have been due to excess soft tissue tension in some of the more complex knees. The two groups were comparable in terms of all measured variables except weight and sex with both variables favoring the MIS TKA group, thus eliminating the possibility of inadvertent selection bias since we found no benefit to MIS surgery. Comparison to the registry further insures that the entire cohort is representative of our patient population.

As a result, the senior author (SAB) has now abandoned any attempt at curtailing the skin incision to 10 or the VMO split to 1-2 cm. Currently, the more extensile Tri-vector approach is favored, starting with a 1 cm incision and extending it as needed. The incision length now varies according to the size of the distal femur and length of the patellar tendonThe current surgical technique incorporates ideas and instrumentation of MIS surgery without compromising visualization, component position or patient outcomes.

Conclusion

When controlling for peri-operative pain management and therapy, MIS surgery was associated with more pain at 6 weeks than standard incision procedures. There seems to be no benefit to minimally invasive (<10cm) incisions at short term follow up. We do not recommend limiting exposure in an effort to improve short term outcomes

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