© J ORTHOP TRAUMA SURG REL RES
14(1) 2019
Research Paper

Role of pre-operative check list in orthopaedic trauma surgery at tertiary care centre in India

RAJEEV SHUKLA, PRANAV MAHAJAN, RAVI KANT JAIN
Sri Aurobindo Medical College and PG Institute ,Indore, Madhya Pradesh, India

Address for correspondence:
Pranav Mahjan, Sri Aurobindo Medical College and PG Institute, Indore, Madhya Pradesh, India
pranav.mahajan@gmail.com

Statistics

Figures	07
Tables	04
References	11

Received: 18.06.2018
Accepted: 22.01.2019
Published: 01.02.2019

Abstract

Introduction: Pre-operative planning is one of the most important aspects in surgical treatment of patients in modern day surgery. It helps in reducing the common errors before and during surgery and hence saves time, labour and benefits the patient.

Materials and Methods: In this study, we analyzed the role of pre-operative checklist in planned orthopaedic surgical procedures. We included adult trauma patients who had closed fracture of upper or lower limb and were planned for surgery. One group of patients were monitored and worked up pre operatively as per routine protocols. The second group of patients was strictly monitored according to the points given in the pre-operative check list applied in their case file.

Results: The mean age of the patients was 43.46 years. Majority of patients were males (68.44%). 518 patients were operated by closed techniques. Open techniques were used in 588 patients. The average time taken for surgery in patients in Group A was 59.94 min. (SD 17.66) while that in Group B was 87.72 min. (SD 19.47) Average hospital stay for patients in Group A was 4.34 days (SD 1.77) and for those in Group B was 6.10 days (SD 3.10). There was also variation in the expenditure occurred in the OT in both the groups with an average of Rs. 7146.85 (SD-1869.50) in the Group A and Rs. 8608. 85 (SD-1543.02) in Group B. We also evaluated the individual outcome of different types of fractures in both the groups.

Conclusion: Pre-operative planning in treatment of fracture is an important professional discipline, and familiarity with the process makes it very quick for treatment of fractures. We highly recommend the use of this pre-operative check list criterion to be used in all the surgeries of orthopaedics, especially in elective cases.

Keywords: Pre-Operative check list, Surgical planning, templating, Orthopaedics

Abbreviations: CC: Cannulated Cancellous; DHS: Dynamic Hip Screw; ICU: Intensive Care Unit; OPD: Out Patient Department; OT: Operation Theatre; RR: Relative Risk; SD: Standard Deviation

INTRODUCTION

Pre-operative planning is one of the most important aspects in surgical treatment of patients in modern day surgery. The practice of pre-operative planning is very old and it is usually carried out by surgeons prior to treatment/surgery. It ensures that the patient and his/her attendants are fully informed regarding the condition of the patient, disease condition of the patient, about the procedure planned during surgery, possibility of any complications intra and post-operatively and the post-operative recovery. Pre-operative planning also ensures that patient is in optimum health to undergo surgical procedure and has made arrangements for admission, discharge and post-operative care at home as and when required.

Most orthopedic residents are introduced to pre-operative planning during their residency days. AO (Arbeitsgemeinschaft für Osteosynthesefragen- Association for the study of internal fixation) fracture management course emphasizes formal planning prior to surgery and teaches the principle 'failing to plan is planning to fail [1].

The basic training of residents begins with the ward work which includes preparation of daily orders, developing interaction skills with patients and their attendants, understanding the basic medications which are routinely used for the patients, their practical usage, side effects, interactions, complications related to the disease condition, etc. The next step to observe and learn is to observe patients coming in outpatient department, examination of patients, diagnosing the disease condition, etc. The next step in the learning process is pre-operative planning in patients who are having some disease/orthopaedic condition which will require surgery. Pre-operative planning is important in each and every patient whether planned for a major or a minor surgical procedure.

Since our main interest of the study is trauma cases, we will be talking more commonly about trauma cases coming in the OPD of an Orthopaedic surgeon and how the treatment follows. All the major trauma patients coming in OPD at a tertiary care centre and requiring surgery should be taken care of from many perspectives.

First of all, the patients should be managed primarily depending on the fracture. The fracture site should be immobilized with a splint or slab or traction depending on the injury. Patients should be investigated for ruling any other associated comorbidity. As most of the trauma patients require surgery, they should be investigated to see if they are fit for surgery.

The next important step is pre-operative planning. This is important to ensure less possibility of complications and better results.

A survey of pre-operative planning practices in the United Kingdom in 1998 found that 94% of consultants and 100% of residents thought that planning was important; however, only half of those routinely planned fracture surgery [2]. Formal pre-operative planning should be recognized as an essential prerequisite to fracture management because of the potential to improve surgical efficiency, and advance orthopedic surgical training [3].

VALUE OF PRE-OPERATIVE PLANNING TO THE SURGEON AND TRAINEE

Pre-operative planning fracture surgery provides numerous benefits to a surgeon. Disciplined formal planning increases surgical efficiency and decreases stress in the operating room [3]. Moreover, having a plan and conveying it pre-operatively provides an excellent opportunity to communicate with and educate those involved in a case, including residents, medical students and operating room personnel. Pre-operative planning improves with routine practice. Patients also benefit from pre-operative planning because of improved outcomes and increased safety [3].

In addition to the value offered to the surgeon and patient, planning has tremendous medical educational benefits: it forces careful analysis.

As orthopaedic residents become more proficient in interpreting images, they learn that fractures tend to follow predictable patterns. All orthopaedic surgeons experience a time when a subtle variation was overlooked. With careful review of images during pre-operative planning, such variations are more likely to be noticed and potential intra-operative difficulties can be avoided. Furthermore, formal planning facilitates mental rehearsal of operative plans. This can prevent unanticipated problems. Formal planning forces residents to make decisions, it stimulates discussion and makes for a more efficient and cohesive approach during surgery. A concrete, drawn-out plan stimulates discussion with an attending surgeon prior to entering the operating room, for instance, and results in an increase in resident engagement with cases, operative understanding, and improves confidence. As a resident progresses and gains experience, different elements of planning become more meaningful.

There have been a few studies considering the importance of pre op planning in our day to day practice. One should start learning the concepts of pre-operative planning during their residency days itself so that by the end of their curriculum, the residents have a complete idea of how to evaluate the patient pre operatively and also what things should be given stress upon while looking after the patient.

We have designed a basic pre-operative check list for the residents working at any institute in order to evaluate the details of the patient prior to surgery. This would help the surgeon and residents in better dealing with the surgery. The check list has to be applied in the case file of the patient so that the resident doctor knows exactly what all things need to be done prior to surgery.

MATERIALS AND METHODS

This study includes 1106 patients who were admitted at our hospital and suffered from fracture in upper or lower limb. These patients were planned for some surgical procedure.

As soon as the patient came to us in OPD/Emergency after a history of trauma, he/she was taken in the emergency room. Detailed history of all patients was taken. All patients were assessed clinically and functionally to determine the type of fracture. The pre-operative medical evaluation of all patients was done to prevent potential complications that can be life threatening or limb threatening. Standard guidelines were utilized to get radiographs-standing antero-posterior view and lateral view of the involved bone is done. Any associated ligament laxity, subluxation of surrounding joint, presence of any bony defects or pathological condition in the bone and the quality of bone was assessed.

All of these patients who had a long bone fracture were primarily managed with i.v. fluids, analgesics, immobilization of the fracture site.

Patient and attendants are explained regarding the condition of the patient. They are explained regarding the type of fracture and the proposed treatment plans.

All the patients who are more than 18 years of age and suffering from upper limb or lower limb closed fracture of long bone were included in the study. Patients in the age group <18 years, open fractures, multiple fractures, any other associated co-morbidity which can lead to delay in surgery or post op monitoring in ICU

care, patients having deranged blood investigations are excluded from the study. Patients were randomly divided into two groups after their inclusion in the study.

In one group, no pre op check list was applied. All the patients were planned for surgery following the routine pre-operative protocols. These patients were evaluated for total surgical expenses, surgical time, and surgical complications during and after surgery, total duration of stay after surgery.

In the second group of patients, pre op check list is applied after the patient is admitted. All the points given in the checklist are checked and done prior to surgery (Table 1).

All patients after thorough pre-op evaluation were taken up for surgery by the same surgical team under general or regional anesthesia. Tourniquet was applied whenever required and sterile preparation done from thighs to toes and draped.

In the second group of patients where Pre-operative check list is applied in case file are monitored for Pre Anesthetic Checkup, all relevant clearances, investigations, consent, pre op medical and OT charges, blood arrangement, implants check for plan A or B, tentative size of implant required, case planning including surgical approach, procedure, plan to be mentioned on white board prior to start of surgery.

Patient is monitored intra-operatively and post-operatively for total surgical time, total surgical cost (intraoperative), any intra op or post op complications, and total duration of stay after surgery. All the patients were operated by the same surgical team. Patients of both the groups are analyzed using MedCalc software.

RESULTS

The study was done in a total of 1106 patients who had a history of trauma and sustained fractures in the bones of upper and lower limbs. All the patients considered for the study had unilateral injuries with single bone involvement.

Out of the total patients, 546 patients had pre op check list attached to their files before surgical workup (Group A) whereas 560 patients were planned for surgery as per the routine protocols (Group B) (Tables 1 and 2).

The fracture pattern was similar in both the groups with 176 upper limb patients and 369 lower limb patients in Group A while there were 188 upper limb patients and 372 lower limb patients in Group B (Table 3).

The mean age of the patients was 43.46 years (Range-18-90 years) (Fig. 1). Majority of patients (757) were males (68.44 %) (Fig. 2).

In group A, out of 546 patients, 249 patients were operated by closed reduction internal fixation techniques and 297 patients were operated upon by open reduction internal fixation techniques (Fig. 3).

518 patients were operated by closed techniques (22 patients with CC Screws, 11 DHS, 109 external fixator, 347 nailing, 26 pinning. Open techniques were used in 588 patients out of which 40 were Hemi Arthroplasty, 29 Dynamic Hip Screw, 35 CC Screws, 6 Nailing, 436 plating, 40 Tension Band Wiring (Fig. 4).

The average time taken for surgery in patients in Group A was 59.94 min. (with SD 17.66) while that in Group B was 87.72 min. (SD 19.47) and was found to be significant ($p<0.0001$) (Fig. 5).

Average hospital stay for patients in Group A was 4.34 days (SD 1.77) and for those in Group B was 6.10 days. (SD 3.10) was found to be significant ($p<0.0001$) (Fig. 6).

There was also variation in the expenditure occurred in the OT in both the groups with an average of Rs. 7146.85(SD-1869.50) in the Group A and Rs. 8608. 85 (SD-1543.02) in Group B and this was also found to be significant ($p<0.0001$) (Fig. 7).

We also evaluated the individual outcome of different types of fractures in both the groups, the details of which are shown in Table 4.

DISCUSSION

The importance of planning before performing an operation is well-understood and documented. Planning helps the surgeon anticipates the correct implant size and can also help to anticipate possible

Table. 1. Pre op check list proforma

Pre op check list proforma

Primary Details:-

Patient Name:
Age: Sex:
Ward: IPD No.:
Diagnosis:

Pre Op Check List

1. Pre Anaesthetic Checkup
2. All relevant clearances
3. Latest investigations, if applicable
4. Consent
5. High risk consent, if applicable
6. Pre operative Consent form
7. Pre operative OT Charges
8. Blood Arrangements, if applicable
9. Pre op X rays-standard views
10. Part Preparation
11. Side Determination and marking prior to surgery
12. Intensive Care Unit Bed Arrangement, if applicable
13. Complete Diagnosis in OT List
14. Pre operative templating and planning-All case discussions with alternatives/implants
15. Implant Check-Plan A, Plan B
16. Size of Implant-Clinical and Radiological
17. Residents OT Case Distribution
18. Surgical Approach and Procedure study by assistants and residents.
19. Information about patient to consultant in evening prior to surgery
20. OT Order discussion with consultant
21. Figure of surgical procedure drawn on White Board in OT

Table. 2 . Distribution of patients according to fracture

Bone Fracture	Number of Patients		
	Group A	**Group B**	**Percentage**
Clavicle	19	21	3.61%
Humerus	106		9.58%
- Proximal Humerus	12	14	
- Neck Humerus	4	2	
- Shaft Humerus	28	31	
- Distal Humerus	7	8	
Radius/Ulna	223		20.16%
- Olecranon	7	10	
- Proximal Radius/ Ulna	4	2	
- Shaft Radius	27	19	
- Shaft Ulna	9	10	
- Shaft Radius and Ulna	28	28	
- Distal Radius	36	43	
Femur	381		34.44%
- Neck Femur	44	40	
- Inter trochanteric Femur	57	58	
- Sub Trochanteric Femur	24	25	
- Proximal Femur	11	7	
- Shaft Femur	21	29	
- Distal Femur	33	32	
Patella	12	17	2.62%
Tibia/Fibula	271		24.50%
- Proximal Tibia	32	31	
- Shaft Tibia/Fibula	50	54	
- Distal Tibia	32	32	
- Medial Malleolus	12	16	
- Bimalleolar	7	5	
Talus	3	4	0.63%
Calcaneum	27	22	4.43%

Table. 3. Distribution of patients according to procedure

Criteria	Group A	Group B
Age	43.60 years	43.32 years
Sex	M 397: F 163	M 373:F 187
Fracture Pattern		
- Upper Limb	176	188
- Lower Limb	369	372
Procedure Done		
- Open	298	291
- Closed	249	269
Type of Implant		
- Pinning/TBW	27	39
- Screw/DHS	60	49
- Nail	166	187
- Plate	220	217
- Fixator	52	48
- Hemi Arthroplasty	21	19
Time of Surgery	59.94 min.	87.72 min.
Cost of Surgery	Rs. 7146.84	Rs. 8608.85
Duration of Stay	4.34	6.10 days
Complications	2.38 %	3.03%

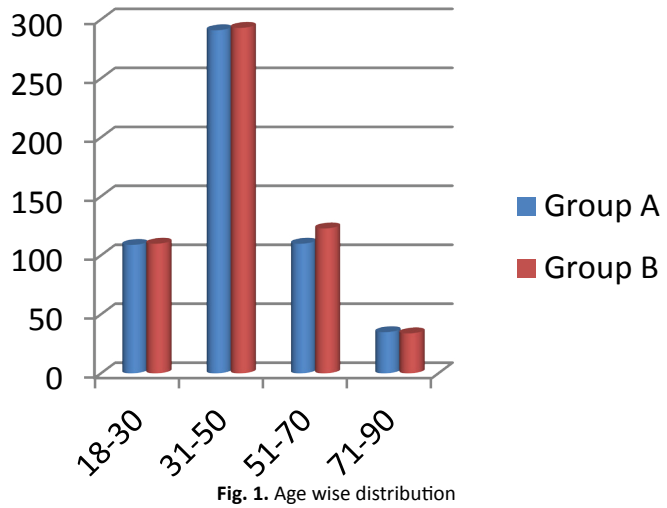

Fig. 1. Age wise distribution

intra-operative difficulties (more than 80% of intra-operative difficulties were anticipated in the study performed in study by S Eggli et al.) [4].

Our study shows the importance of pre-operative checklist at a tertiary centre which is very much helpful for residents during their learning days. We have determined that there is a definite advantage of applying a pre-operative check list prior to surgery. We found that there was a significant difference (around 30%-40%) in time of surgery in the two groups with lesser time in group in which pre-operative check list was used. Similarly, there was reduction in cost of surgery by around 10%-20% in group A patients. Also, there was partly reduced stay in hospital in patients of group A (Table 4).

The systematic analysis of a problem requires discipline. It requires a review of the information that we do have, a search for information that we do not have, and consistent and correct application of that combined knowledge to each situation. When the full body of experience does not provide an answer, mistakes are easier to accept. When an answer is present but we fail to see it,

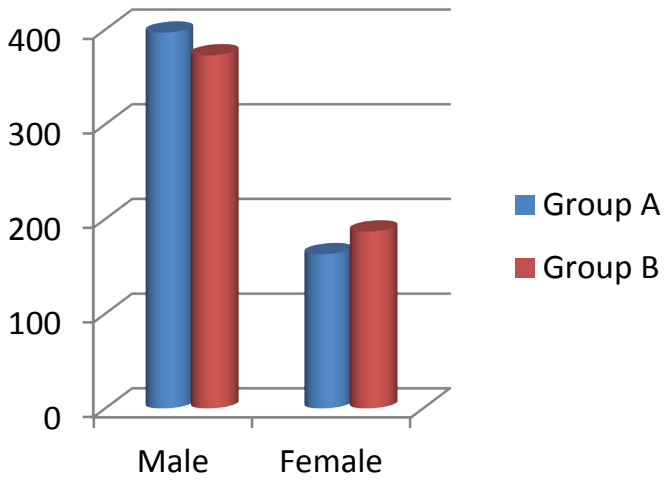

Fig. 2. Sex distribution

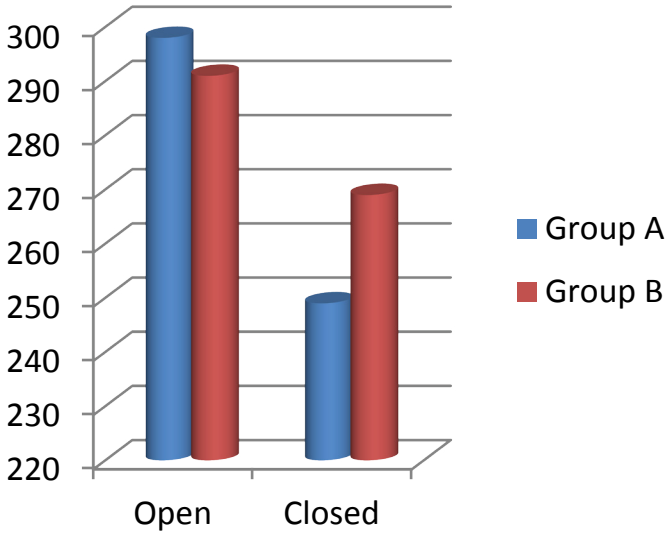

Fig. 3. Type of surgery done

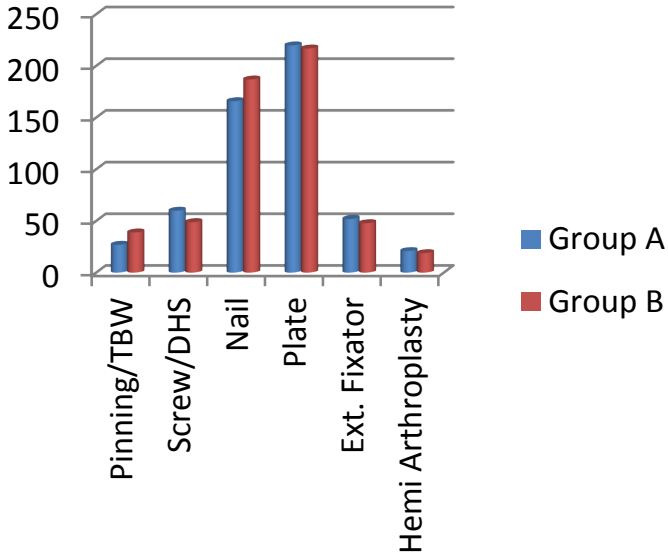

Fig. 4. Procedure done

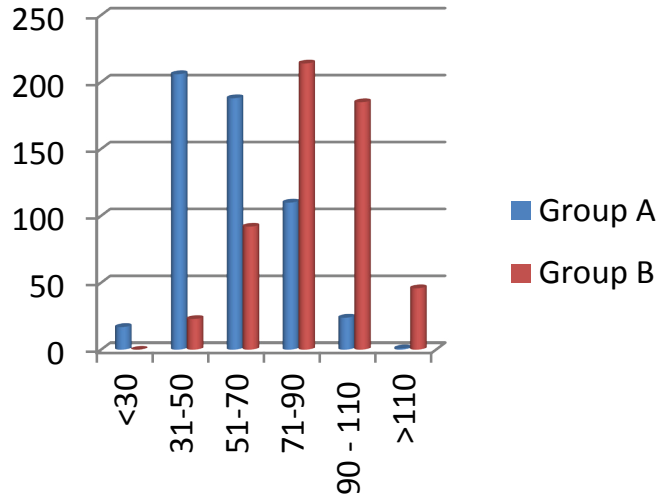

Fig. 5. Duration of surgery (in minutes)

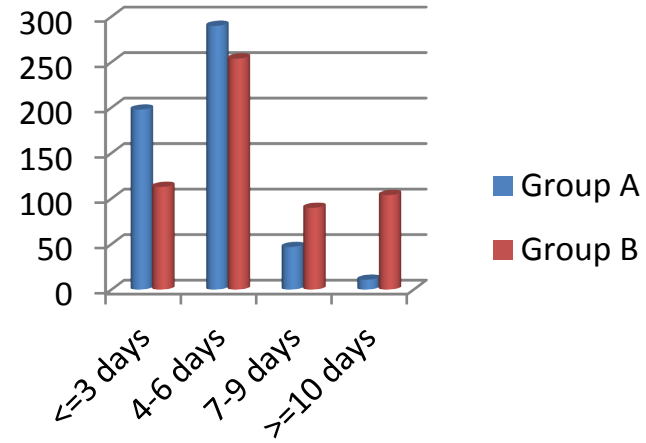

Fig. 6. Duration of stay

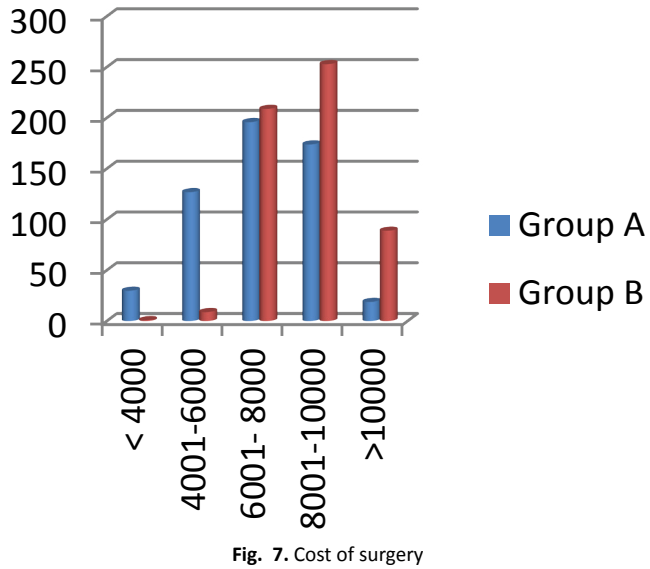

Fig. 7. Cost of surgery

failure is both more frustrating and less acceptable [5].

According to one of the studies done by Paul O Connor et al. [6], surgical check lists has been shown to improve patient safety and team work in the operating theatre. Responses were obtained from 107 theatre staff. The overall attitudes towards the effect of the checklist on safety and team working were positive. However, there was a lack of rigour with which the checklist was being applied (46% response rate).

Mathew Sewell et al. [7], in their study determined the role of WHO surgical safety checklist in orthopaedics and trauma patients.

Table. 4. Categorical distribution of patients according to fracture

	Group A				Group B				
Bone Fracture	**No. of Pts.**	**Time (min)**	**Cost (Rupees)**	**Duration of Stay(days)**	**No. of Pts**	**Time**	**Cost**	**Duration**	**Percentage**
Clavicle	19	67.10	8308.42	4.05	21	96.19	9135.23	6.71	3.61%
Humerus	106								9.58%
- Proximal Humerus	12	68.75	8451.66	5.16	14	108.21	10115.71	7	
- Neck Humerus	4	41.25	4452.5	3.25	2	87.5	8895	3.5	
- Shaft Humerus	28	58.39	6712.5	4.25	31	83.22	7898.71	5.35	
- Distal Humerus	7	98.57	8285.71	6.71	8	125	11908.75	9.87	
Radius/Ulna	223								20.16%
- Olecranon	7	55.71	4440	4.42	10	91.5	7715	5.8	
- Proximal Radius/ Ulna	4	47.5	6277.5	3.75	2	75	7945	8	
- Shaft Radius	27	47.03	5308.88	4.40	19	81.05	6868.42	5.36	
- Shaft Ulna	9	38.33	5118.88	3.33	10	70.5	6568	6.5	
- Shaft Radius and Ulna	28	85.35	6214.64	4.60	28	89.82	7932.5	5.78	
- Distal Radius	36	46.38	5310.83	4.05	43	73.60	7810.93	5.02	
Femur	381								34.44%
- Neck Femur	44	62.38	9015	4.34	40	91.25	9336.25	6.2	
- Inter trochanteric Femur	57	56.66	8548.77	4.29	58	83.27	9265.69	5.87	
- Sub Trochanteric Femur	24	65.83	8078.33	4.62	25	93.4	9304.8	6.08	
- Proximal Femur	11	72.27	8494.54	5	7	111.42	9207.14	6.71	
- Shaft Femur	21	55.95	7472.85	3.80	29	79.37	8730.34	5.72	
- Distal Femur	33	74.24	8761.51	4.84	32	99.68	10536.25	7.62	
Patella	12	64.16	4460.83	4.66	17	92.94	7482.35	6.11	2.62%
Tibia/Fibula	271								24.50%
- Proximal Tibia	32	60.00	7491.56	4.12	31	95.64	9120	6.58	
- Shaft Tibia/Fibula	50	52.7	6816.2	4.2	54	79.44	7468.33	5.75	
- Distal Tibia	32	65.62	7613.12	4.59	32	96.09	9158.43	6.37	
- Medial Malleolus	12	36.66	3527.5	3.5	16	72.81	7530	3.93	
- Bimalleolar	7	62.85	5970	3.71	5	88	8014	6.4	
Talus	3	55	6903.33	3	4	71.25	6872.5	4	0.63%
Calcaneum	27	53.33	6240.74	4.44	22	89.09	8626.81	8.13	4.43%

The aim of this study was to prospectively audit checklist use in orthopaedic patients before and after implementation of an educational program designed to increase use and correlate this with early complications, mortality and staff perceptions. Data was collected on 480 patients before the educational program and 485 patients after. Pre-training checklist use was 7.9%. The rates of early complications and mortality were 8.5% and 1.9%, respectively. Forty-seven percent thought the checklist improved team communication. Following an educational program, checklist use significantly increased to 96.9% (RR12.2; 95% CI 9.0–16.6). The rate of early complications and mortality was 7.6% (RR 0.89; 95% CI 0.58-1.37) and 1.6% (RR 0.88; 95% CI 0.34-2.26), respectively. Seventy-seven percent thought the checklist improved team communication.

Avish L Jain et al. [8], performed a study on impact of a daily pre-operative surgical huddle on interruptions, delays, and surgeon satisfaction in an orthopedic operating room. 19 baseline observations and 19 huddle-implemented observations of surgeon's days were assessed. Overall, surgeon satisfaction increased and fewer delays occurred after introduction of huddles. Interruptions decreased in all categories including equipment, antibiotics, planned procedure and side. Time required for a huddle was less than one minute per case.

Alex B Haynes et al. [9], did a study determining the role of Surgical Safety Checklist to Reduce Morbidity and Mortality in a Global Population. They collected and enrolled patients from 8 different cities all over the world representing a variety of economic circumstances and diverse populations of patients who participated in the World Health Organization's Safe Surgery Saves Lives program. They subsequently collected data on 3955 consecutively enrolled patients after the introduction of the Surgical Safety Checklist. The primary end point was the rate of complications, including death, during hospitalization within the first 30 days after the operation. The rate of death was 1.5% before the checklist was introduced and declined to 0.8% afterward (P=0.003). Inpatient complications occurred in 11.0% of patients at baseline and in 7.0% after introduction of the checklist (P<0.001). They concluded that implementation of the checklist was associated with concomitant reductions in the rates of death and complications among patients at least 16 years of age who were undergoing noncardiac surgery in a diverse group of hospitals.

William Murzic et. al. presented a study with the aim of evaluating the accuracy of a specific templating software (with an emphasis on femoral component fit) and comparing it to the traditional technique using standard radiographs [10].

Digital pre-operative planning enables the surgeon to select from a library of templates and electronically overlay them over the image. Therefore, the surgeon can perform the necessary measurements critical to the templating and pre-operative planning process in a digital environment. The pre-operative planning process is fast,

precise, and cost-efficient, and it provides a permanent, archived record of the templating process [11].

Successful surgery requires the precise placement of implants in order that the function of the joint is optimized both biomechanically and biologically. Pre-operative planning is helpful in achieving a successful result in total joint replacement. Pre-operative templating in total hip replacement helps familiarize the surgeon with the bone anatomy prior to surgery, reducing surgical time as well as complications [11].

CONCLUSION

Fracture planning can seem time consuming and labor intensive. However, it is an important professional discipline, and familiarity with the process makes it very quick for simple fractures, though more complex fractures take longer. Just as important as the process of drawing the plan and determining the tactic is the task of considering surgical management in detail. The whole process makes it far less likely that X-rays will be misinterpreted, surgical pitfalls overlooked, and the correct size implant found to be unavailable after the operation has started. The benefits to the surgeon and residents of a planned approach far outweigh the time necessary for the planning itself. A good plan frequently results in a shorter operating time and a better outcome for the patient.

References:

1. *Ruedi T.P., Buckley R.E., Moran C.G.: AO principles of fracture management. Switzerland; AO Publishing, 2007.*
2. *Wade R.H., Kevu J., Doyle J.: Pre-operative planning in orthopaedics: a study of surgeons' opinions. Injury. 1998;29:785-786.*
3. *Hak D.J., Rose J.: Pre-operative planning in orthopedic trauma: benefits and contemporary uses. Orthopedics. 2010;33:581-584.*
4. *Eggli S., Pisan M., Mãijller.: The value of pre-operative planning for total hip arthroplasty. The Journal of Bone Joint Surgery. 1998;80:382-390.*
5. *Nelson O., Quinn T.D., Arriaga A.F.: A model for better leveraging the point of pre-operative assessment: patients and providers look beyond operative indications when making decisions. A A Case Rep. 2016;6:241-248.*
6. *O'Connor P., Reddin C., O'Sullivan M.: Surgical checklists: the human factor. Patient Saf Surg. 2013;7:14.*
7. *Sewell M., Adebibe M., Jayakumar P.: Use of the WHO surgical safety checklist in trauma and orthopaedic patients. Int Orthop. 2011;35:897-901.*
8. *Jain A.L., Jones K.C., Simon J.: The impact of a daily pre-operative surgical huddle on interruptions, delays, and surgeon satisfaction in an orthopedic operating room: a prospective study. Patient Saf Surg. 2015;9:8.*
9. *Haynes A.Bl., Weiser T.G., Berry W.R.: Safe surgery saves lives study group. a surgical safety checklist to reduce morbidity and mortality in a global population. N Engl J Med. 2009;360:491-499.*
10. *Murzic J.W.M.D., Glozman Z.B.S., Lowe P.R.N.: The accuracy of digital (filmless) templating in total hip replacement. 72nd annual meeting of The American Academy of Orthopaedic Surgeons in Washington, DC, February 23-27, 2005.*
11. *Bono J.: Digital templating in total hip arthroplasty. J Bone Joint Surg Am. 2004;86:118-122.*