

Research Article

“Detection of Total Knee Arthroplasty at Airport Securities”

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Abstract: Background: In era of increased air travel, airport security screening measures has been increased. A lot of anxiety to the patient that may trigger an alarm at airport securities post-surgery. The purpose of this study is to find out experiences of patients after total knee arthroplasty (TKA) passing through airport security. **Methods:** A retrospective case series of 250 TKA patients in a single high-volume center from January 2017 to January 2019, who had passed through airport security and met inclusion criteria. Patients were contacted during their regular follow ups or via phone. The patients were asked for alarm trigger, perceived inconvenience, whether security officials asked to show documentation regarding prosthesis, and any extra screening procedures check measures. **Results:** Out of 250 patients, 52 patients met inclusion criteria travelling by airplane. 27 patients reported alarm trigger. 7 patients had to undergo additional security check measures. 43% of the patients believed that having their TKA increased the inconvenience while traveling. **Conclusions:** This study provides information to surgeons regarding airport travel post TKA. Patients can be counselled regarding the inconvenience and to be prepared for delays in airport and to be prepared to present documentation of their prosthesis.

Keywords: Airport, Total knee arthroplasty, Security check.

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INTRODUCTION

The number of joint replacement surgeries performed worldwide continues to increase annually and it has been predicted that there will be 3.48 million total knee replacements worldwide annually by the end of 2030[1]. The frequency of air travel increased in the recent decade and awareness of terrorism raised the sensitivity of security checks. Patient frequently ask whether any issue regarding airport travel post total hip replacement.

There are no reports published from India examining how this affects patients who have undergone total knee arthroplasty. There have been several studies that have reported that 47% to 88% of patients trigger the security checkpoint alarms with their orthopaedic hardware [2]. But factors like speed of passing through the metal detector arch, patient BMI, implant weight and composition of metal may alter the results [3]. In a study done by Josef G *et al.* stated that implants weighing more than 145g triggered an alarm [4]. Implants with cobalt chromium alloys were more sensitive to metal detector than titanium and stainless steel [5].

The purpose of this study was to assess the patients who had passed through airport security and to find out the incidence of alarm trigger, inconvenience in

airport, extra security check measures and role of document regarding implant in the body.

METHODS

This is a retrospective case study. The eligibility criteria for selection of patients sampling in the study included are, firstly, all TKA patients operated between January 2017 to January 2019 at The Calcutta medical research institute, India and secondly all patients travelling through airport security. Patients were contacted during follow ups or via phone call. Patients were asked for a set of questions regarding alarm trigger in airport, perceived inconvenience, extra security check measures, whether they have taken any document from hospital regarding implant, and whether they were asked to show document.

All data were put into a Microsoft excel for statistical analysis. Statistical comparisons between the present study and their comparative recent study were compared using a Z test for population proportions. A p value of less than 0.05 was considered statistically significant.

RESULTS

Out of 250 patients contacted during study period, 52 patients had history of traveling through airport security (right sided TKA- 27, left TKA-19 and

bilateral TKA-6) (Figure 1). Of these 52 patients, 27 (52 %) reported that they had alarm trigger. 18 (34%) patients took document from hospital while travelling. 11 patients were asked to show document regarding the implant, rest were given oral explanation. 7 out of 52 patients underwent extra security check measures. Out of which, 4 patients were asked to show scar of surgery (Figure 2). One patient had to undergo full body search in American embassy. Overall, 22 of the 52 patients (42%) believed that having a joint prosthesis increased the inconvenience of airplane travel.

When compared to Issa *et al.* in their study, patients had reported that alarms were triggered in 10 out of 51 (20%; p=0.0000) patients [1]. 13 of 51 (25%; p=0.0023) reported that having a prosthesis caused them inconvenience while travelling. Both were statically significant. However, the incidence of those subjected to more invasive search methods was similar (n=5 of 51 patients; p=0.2354) not statistically significant.

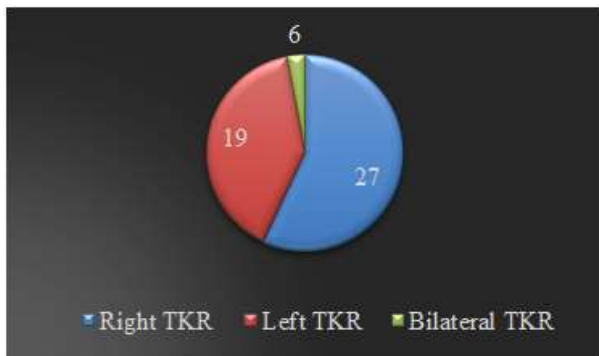


Fig-1: Nature of TKR (total knee replacement)

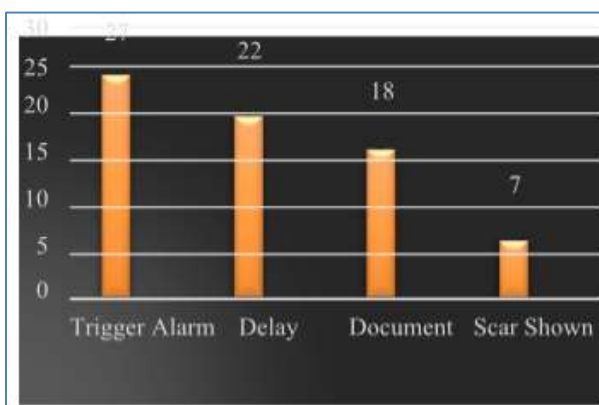


Fig-2: Nature of security check

Table-1: Gender variatio

Security check	Male	Female
Trigger alarm	15	12
Delay	12	10
Document	10	8
Shown scar	4	3

Table-2: Side variation

Side	Right	Left	Bilateral
Tigger alarm	13	10	4
Delay	11	8	3
Document	8	7	3
Shown scar	1	4	2

DISCUSSION

Joint arthroplasty implants are commonly detected at airport securities even with low security standards [6]. Airport metal detectors use electromagnetic fields to detect metals. This equipment create electromagnetic fields from the source and when a metal is passed through these fields undergo temporary magnetization and generate a conduction, disturbing the electromagnetic field allowing a trigger of alarm [7]. Magnetic metals such as iron, nickel and cobalt produce induction currents, which are detected by the device. Detection is known to depend on a variety of factors: sensitivity setting of the detector, metallurgical composition, mass and even the side of the implant has all been implicated [8].

Pearson *et al.* found that ferrous content in implant alloy was the cause of alarm trigger [9]. Cobalt-chromium and titanium implants were detected more often than were those made of stainless steel. This pattern was consistent among the different types of implants, with titanium plates being detected more often than stainless-steel plates and titanium prostheses being detected more often than stainless-steel prostheses [6].

Asch *et al.* conducted a sensitivity test by 3 types of metal detectors and concluded that orthopaedic trauma implants like screws, plates and pins went undetected by arch detectors but detected by hand detectors, where as in joint replacements were detected by arch detectors [10]. In our study 52% of patients reported that they had alarm trigger at airport.

Abbassian *et al.* found that the knee prostheses are significantly more likely to be detected than hip prostheses. Interestingly, both implants have similar weight and magnetic metal composition. The difference in the detection rate might, therefore, be because hip prostheses are deep, intramedullary implants that have a greater degree of shielding by way of cement, bone and soft tissues [8].

Ramirez *et al.* compared the detection of orthopedic implants by metal detectors found that 77 and 88% of all arthroplasties were detected using low and high-sensitivity metal detectors, respectively [6]. Furthermore, these arthroplasties were more likely to be detected than a variety of other implants Therefore; they concluded that, amongst patients with orthopaedic implants, those with joint arthroplasties were far more likely to experience inconvenience when travelling. No correlation was found between the patient body mass

index and the likelihood of detection with the archway detector. The main limitation of the study is, it is a small number case series and need to be studied in a larger group.

CONCLUSION

We advise surgeons to provide documentation regarding surgery and prosthesis to prove the presence of an orthopaedic implant to all patients. Chances of invasive searches are less likely after showing documentary evidence in some patients. Patients should be counseled well that they should expect delays and be prepared for such inconveniences.

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