ORIGINAL ARTICLE

Total Knee Arthroplasty Complicated by Distal Deep Venous Thromboembolism: Does it Affect the Functional Outcome?

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ABSTRACT

The aim of this study is to determine the outcome of total knee arthroplasty (TKA) following patients with and without deep vein thrombosis (DVT) using patient-reported quality of life outcomes and therapist-reported knee range of motion. We carried out a retrospective study of 157 patients who underwent primary TKA at one large regional hospital. Thirty-six patients developed DVT after TKA. We scored patients at pre-operation, six months and two years post-operation using Short Form-36, Knee Society Clinical Rating System, Oxford 12-item Knee Score questionnaires, and knee range of motion. Our study found that there was no significant difference in the patient-reported quality of life outcomes and therapist-reported knee range of motion between patients who had developed DVT and those who did not.

Keywords: Deep vein thrombosis, Quality of life outcomes, Range of motion, Total knee arthroplasty

INTRODUCTION

Deep vein thrombosis (DVT) following total knee arthroplasty (TKA) and its sequelae post-thrombotic syndrome is a major health concern. The incidences of DVT reported in Asia following various orthopaedic procedures vary and have been reported to be as high as 53.3%[1–3]. In a review of Asian patients, the pooled rate of symptomatic DVT following TKA was found to be 4.5%, and the pooled rate of symptomatic pulmonary embolism (PE), a potentially fatal complication of DVT, was found to be 0.6%[4]. In the same review study, no patients died of PE. Another potential complication of DVT is the development of post-thrombotic syndrome (PTS), which involves, among many symptoms, leg swelling, pain, and skin discolouration[5].

In a study of quality of life as a long term outcome of DVT, Kahn et al. (2000) reported that patients with symptoms of PTS described poorer perceptions of health, and more severe limitations in physical functions[6]. Even though studies have suggested that the rates of DVT and PE are low in Asian patients, no study has investigated the effect of DVT on the functional outcomes of TKA. Hence, the aim of this study is to determine the outcome of total knee replacement following patients with and without deep venous thrombosis using patient-reported quality of life outcomes and therapist-reported knee range of motion.

PATIENTS AND METHODS

We obtained institutional review board approval for a retrospective study of 157 patients from the period January 2001 to December 2001. All patients who underwent primary TKA for osteoarthritis were included in this study. Patients who underwent TKA for rheumatoid arthritis, and septic arthritis, and patients who underwent revision TKA were excluded from this study.

All patients had their primary surgeries undertaken

at one large regional hospital by the same arthroplasty service unit. As far as possible, all operative factors such as tourniquet times, and surgical approaches, were standardised. All patients underwent the same post-operative regime and were started on weight bearing exercises and continuous passive motion on post-operative day 1. All patients, regardless of symptoms, were evaluated for DVT status with duplex ultrasonography scans during their inpatient stay after surgery on POD 5. All scans were administered by trained therapists at the vascular imaging unit, who were blinded to the objective of the study. Thromboprophylaxis consisted of graduated compression stockings and early mobilisation. Routine chemical thromboprophylaxis was not given.

All patients were followed-up for two years after operation and scored at pre-operation, six months and two years post-operation using Medical Outcomes Study Short Form-36 (SF-36), Knee Society Clinical Rating System (knee and function scores), and Oxford 12-item Knee Score questionnaires. At the same time points, knee range of motion was also measure by means of goniometry. Evaluation was carried out by therapists, trained in administering the questionnaires and goniometric measurements. Therapists were blinded to the objective of the study.

Thromboprophylaxis consisted of graduated compression stockings and early mobilisation. Routine chemical thromboprophylaxis was not given. Patients with DVT of the proximal segment received warfarin therapy for three months post-surgery.

Statistical analysis

Mann-Whitney test was used to compare the SF-36, Knee Society Clinical Rating System, Oxford 12-item Knee Score as well as knee flexion and extension between the DVT and non-DVT group at pre-operative, six and 24 months post-TKA.

All statistical analysis was carried out using SPSS 17.0 (SPSS Inc, Delaware). For all analysis, *p*-value <0.05 was taken as statistically significant.

RESULTS

Our study consisted of 157 patients that were prospectively recruited during their pre-operative consultation. Of the 157 patients, 129 were female and 28 were male. Demographic details of the patients and their pre-operative scores are listed in Table 1 (please see overleaf). Of the 157 patients, 121 patients did not develop DVT and 36 patients (24.8%) developed DVT. At both the six- and 12-month time points, two patients from the DVT group were lost to follow-up.

Comparing the pre-operative demographics, significant differences were observed when comparing the age of DVT and non-DVT patients (p=0.039), while no significant differences were noted when comparing their body mass index (p=0.741). In terms of pre-operative clinical scores, significant differences between DVT and non-DVT patients were only observed in SF1: Physical functioning (p=0.031), SF6: Social role functioning (p=0.031), SF7: Emotional role functioning (p=0.027), and Oxford Knee Score (p=0.040).

At six months post-TKA, significant differences between DVT and non-DVT patients were noted in SF5: Vitality (p=0.035), and continued to be observed in SF6: Social role functioning (p=0.001) and Oxford Knee Scores (p=0.016). By 24 months post-TKA, no significant difference between DVT and non-DVT patients was observed in all clinical scores.

In terms of knee flexion, both DVT and non-DVT patients demonstrated no significant difference at pre-operative (p=0.654), six months post-TKA (p=0.783), and 24 months post-TKA (p=0.492). For knee extension, similar observations were made (pre-operative: p=0.341; six months post-TKA: p=0.955, 24 months post-TKA: p=0.155).

DISCUSSION

The primary objective of this study was to investigate how post-operative DVT affects the functional outcomes of patients who underwent primary TKA for osteoarthritis. With the exception of the Oxford total score at 24 months, our study found no significant difference in the functional outcomes of TKA between patients with DVT and those without DVT.

The findings of our study suggest that patients who developed DVT after TKA did not have poorer functional outcomes as compared to those who did not develop DVT. Our findings are consistent with those reported by Cordell-Smith et al. (2004),

Table 1. Pre-operative, six and 24 months post-total knee arthroplasty (TKA) – Mean (standard deviation) demographics, scores, and range of motion of deep vein thrombosis (DVT) and non-DVT patients.

Pre-operative	**DVT**	**Non-DVT**	***p*-value**
Age	63.92 (7.80)	67.32 (6.90)	0.039
Body mass index	27.95 (3.90)	27.61 (3.96)	0.741
Male	26	2	
Female	10	119	
SF1: Physical functioning	29.72 (22.61)	36.24 (19.25)	0.031
SF2: Physical role functioning	38.53 (39.57)	53.80 (38.85)	0.053
SF3: Bodily pain	37.14 (21.53)	42.31 (19.85)	0.206
SF4: General health	67.33 (22.16)	67.76 (19.71)	0.930
SF5: Vitality	56.67 (23.11)	60.85 (21.57)	0.287
SF6: Social role functioning	54.86 (35.01)	68.68 (34.08)	0.031
SF7: Emotional role functioning	61.39 (47.81)	78.68 (40.49)	0.027
SF8: Mental health	67.28 (21.02)	72.63 (18.48)	0.177
Oxford Knee Score	39.28 (9.14)	35.52 (7.77)	0.040
Function score	39.72 (22.49)	48.10 (18.39)	0.051
Knee score	40.06 (21.35)	43.37 (17.73)	0.324
Extension	8.33 (8.96)	5.62 (6.69)	0.341
Flexion	113.11 (29.53)	119.06 (15.29)	0.654
Six months post-TKA	**DVT**	**Non-DVT**	***p*-value**
SF1: Physical functioning	47.78 (26.66)	53.35 (20.45)	0.167
SF2: Physical role functioning	69.44 (38.78)	78.31 (34.45)	0.149
SF3: Bodily pain	72.33 (19.54)	78.89 (21.27)	0.056
SF4: General health	71.72 (18.04)	74.75 (17.87)	0.112
SF5: Vitality	60.83 (20.93)	68.10 (17.74)	0.035
SF 6: Social role functioning	66.65 (38.84)	88.38 (23.31)	0.001
SF7: Emotional role functioning	88.89 (31.87)	92.56 (26.35)	0.484
SF8: Mental health	77.44 (15.21)	78.53 (13.11)	0.805
Oxford Knee Score	26.22 (8.23)	22.81 (6.66)	0.016
Function score	53.75 (24.77)	59.79 (18.31)	0.083
Knee score	83.69 (13.99)	86.02 (11.74)	0.528
Extension	3.50 (8.09)	2.36 (4.69)	0.955
Flexion	116.19 (13.98)	116.40 (16.85)	0.7832
24 months post-TKA	**DVT**	**Non-DVT**	***p*-value**
SF1: Physical functioning	60.00 (24.29)	60.78 (24.71)	0.900
SF2: Physical role functioning	71.53 (42.74)	80.17 (35.78)	0.292
SF3: Bodily pain	73.22 (24.77)	78.91 (24.27)	0.151
SF4: General health	71.17 (28.38)	77.90 (16.13)	0.966
SF5: Vitality	67.22 (22.94)	68.14 (18.12)	0.903
SF6: Social role functioning	79.86 (35.14)	87.79 (24.72)	0.310
SF7: Emotional role functioning	85.17 (35.15)	94.22 (22.23)	0.090
SF8: Mental health	76.33 (24.45)	77.16 (16.18)	0.286
Oxford Knee Score	20.67 (6.33)	20.46 (6.87)	0.616
Function score	64.44 (26.23)	68.26 (21.91)	0.775
Knee score	82.00 (89.50)	86.47 (11.03)	0.867
Extension	2.22 (5.36)	1.07 (3.35)	0.155
Flexion	118.58 (13.56)	120.45 (13.75)	0.492

who reported that the occurrence of DVT did not compromise patient satisfaction, pain relief, or morbidity[7]. The outcomes measure used by their study was a standard questionnaire at one year. Our study chose to investigate functional outcomes at six months and two years after TKA. We studied the SF-36, Oxford Knee Score, and Knee Society Score, which have been validated in various studies[8–10]. In addition, we also looked into the knee range of motion. To our knowledge, this study is the first of its kind in an Asian population.

A limitation of our study is the use of Duplex ultrasonography in the detection of DVT. Of the various methods, ascending venography is considered the gold standard for diagnosis of DVT[11]. It has been reported that compared to venography, Duplex ultrasonography has lower specificity and sensitivity and may not be able to detect asymptomatic clots[12]. However, duplex ultrasonography is a non-invasive technique that is safe, convenient, and has been increasingly used as an alternative to venography.

Another limitation of our study is that we did not stratify the patients in the DVT group into those who developed PTS and those who did not. As mentioned previously, the development of PTS is associated with poorer perceptions of health and greater physical limitation[6]. We believe that patients who developed PTS were likely to have poorer functional outcomes as compared to those who did not. However, PTS is a syndrome that has a highly heterogeneous presentation and can take on varied severity. Also, the time following DVT at which PTS occurs is unpredictable. Although there are several clinical scales used to define PTS, none have been established as the gold standard in the diagnosis of PTS[13]. In addition, it has been suggested that the diagnosis of PTS should be deferred to about six months after the occurrence of DVT, as this is the amount of time required for pain and swelling associated with DVT to resolve[14]. In view of these difficulties, we did not set out to identify patients in the DVT group who later developed PTS for further subgroup analysis.

One final limitation in this study was the lack of adjustment for confounding factors. Despite efforts to standardise surgical factors, there were still some differences in parameters such as blood loss and operative time. Future studies should employ robust analytical models that take into account the various confounding factors such as these.

CONCLUSION

We believe that the findings of our study challenge the expectation that TKA complicated by DVT is associated with poorer functional outcomes as measured by patient-reported quality of life scores, and therapist-reported range of motions. However, because DVT can lead to chronic complications such as PTS, a follow-up study over a longer period than two years should be carried out to better understand the long term consequences of DVT on the functional outcomes of TKA.

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