

The impact of a muscle pump activator (MPA) on incisional wound healing compared to standard TED stockings and compression devices in kidney and kidney- pancreas transplant recipients. A randomized controlled trail.

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INTRODUCTION

Transplantation is the most optimal mode of renal replacement therapy for patients. Wound infections contribute significantly to postoperative morbidity after kidney and kidney-pancreatic transplantation ^[1] and are, primarily likely attributable to the obligate medication regimented immunosuppression prescribed to these patients. Unfortunately, transplantation is still associated with potential complications such as surgical site wound infection, deep vein thrombosis (DVT), and edema.

The incidence of infectious complications during the first year after renal transplantation was 49% ^[2] and with surgical intervention and wound infections ranging from 10 to 27%.^[3] Some studies documenting simultaneous pancreas and kidney (SPK) transplantation infectious incidence rate >75% surgical site infections, abscesses and urinary tract infections are the most prevalent infection.^[4]

TED STOCKINGS & IPC DEVICES

Traditional methods to prevent edema and DVT use thromboembolism deterrent (TED) stockings and intermittent pneumatic compression (IPC) devices. Both devices promote venous blood flow, which is necessary in the treatment of leg edema. TED stockings are worn on the legs to provide a constant pressure to the limbs. IPC devices consist of an inflatable sleeve that is intermittently inflated and deflated. Both devices have limitations such as decreased comfort for the patient.^[5] IPC devices can also cause excessive heat and sweating under the sleeve, and have inconvenient size, weight, and external power source requirements.^[5]

MPA DEVICE

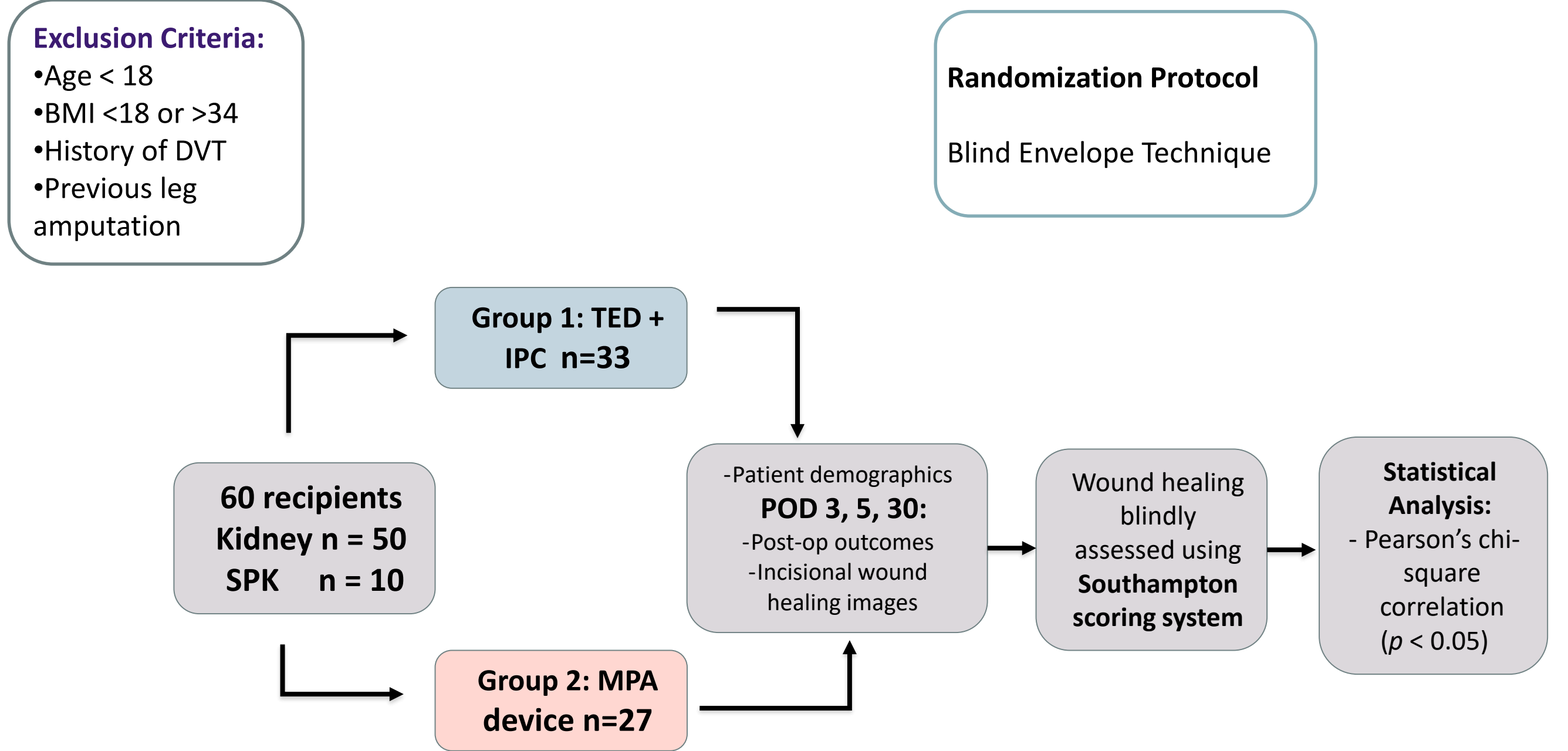
An alternative to TED stockings and IPC therapy is the MPA device. This is a small, self-powered neuromuscular stimulation device that was designed to reduce the risk of DVT and pulmonary embolism.^[6] It has been approved for use by Health Canada. It is attached on the skin over the common peroneal nerve in the legs, where it emits painless, low-voltage electrical impulses to this nerve in order to activate the contraction of the calf muscle.^[6] This improves the emptying of the veins in the legs and increases blood flow to the heart. Wound healing is most efficient with increased blood flow through the body, since increased blood flow enhances Transcutaneous Oxygen Tension (TcPO₂), which is known to be a predictor of tissue viability.^[5,7] The increased blood flow achieved by the MPA device in the lower limbs thus increases TcPO₂, potentially promoting favourable wound healing conditions.

OBJECTIVE

To evaluate the impact of TED+IPC (stockings + intermittent pneumatic compression) versus MPA on incisional wound healing in kidney and SPK transplant recipients with a RCT.

METHODOLOGY

This was an investigator-initiated ethically approved , randomized controlled, double blinded trial. The sample size was estimated to be 60 patients on power calculation.



SOUTHAMPTON SCORING SYSTEM

There is currently no validated tool that is universally used to aid the assessment and management of surgical wounds, however, the Southampton Scoring System is one of the most commonly used assessment.^[8] This system allows one to grade wound healing against specific criteria in order to provide an objective assessment of the wound. It assesses bruising, erythema, discharge, pus, and infection. A lower score indicates better wound healing.

STATISTICAL ANALYSIS

The data obtained from the Southampton Scoring System was analyzed using the Statistical Package for the Social Sciences (SPSS) version 23.0 and JASP program. Pearson's chi-square correlation test and Bayesian simple paired t-test were run to assess the relationship of wound score between TED +IPC and MPA cohorts. P value of < 0.05 was considered to be significant.

Table 1. Southampton Scoring System

Grade	Appearance	Assigned Numerical Score
0	Normal healing	0
I Normal healing with mild bruising or erythema:		1
A	Some bruising	2
B	Considerable bruising	3
C	Mild erythema	4
II Erythema plus other signs of inflammation		5
A	At one point	6
B	Around sutures	7
C	Along wound	8
D	Around wound	9
III Clear or haemoserous discharge:		10
A	At one point only (<2 cm)	11
B	Along wound (>2 cm)	12
C	Large volume	13
D	Prolonged (>3 days)	14
IV Pus:		15
A	At one point only (<2 cm)	16
B	Along wound (>2 cm)	17
V Deep or severe wound infection with or without tissue breakdown; haematoma requiring aspiration		18

RESULTS

Table 2: Demographic and outcomes characteristics

	Type of Recipients		
	IPC+TED	MPA	p-value
Number of patients	33	27	
Age	46 (26-68)	48 (41-64)	0.97
Male: Female	22: 11	18: 9	
BMI	26.2 ± 4.1	25.4 ± 4.8	0.24
Weight	88.3 ± 6	87.5 ± 4	
Type of Surgery:			
Kidney Transplant:	27	23	
Length of stay (days)	6.7 ((± 1.48)	6.4 ((± 1.35)	0.81
DM	16	12	
HTN	7	8	
Vascular disease	4	3	
Complications:			
Superficial wound infection	2	2	
Induction (Thymoglobulin/ Basiliximab)	20/7	18/5	
Kidney+ Pancreas Transplant:	6	4	
Length of stay (days)	9.7 (± 1.82)	9.3 ((± 1.70)	0.92
DM	6	4	
HTN	3	2	
Vascular disease	2	1	
Induction (Thymoglobulin)	6	4	
Complications:			
Superficial wound infection	4	2	

BMI: body mass index. Data are presented as median ± standard deviation.

There are no significant differences in age, sex, BMI and length of stay of recipients in either group (Table 2).



Fig 1. MPA patient post-kidney transplantation. Wound images taken at 3, 5, and 30 post-operative day.



Fig 3. MPA patient post- SKP transplantation. Wound images taken at 3, 5, and 30 post-operative day.

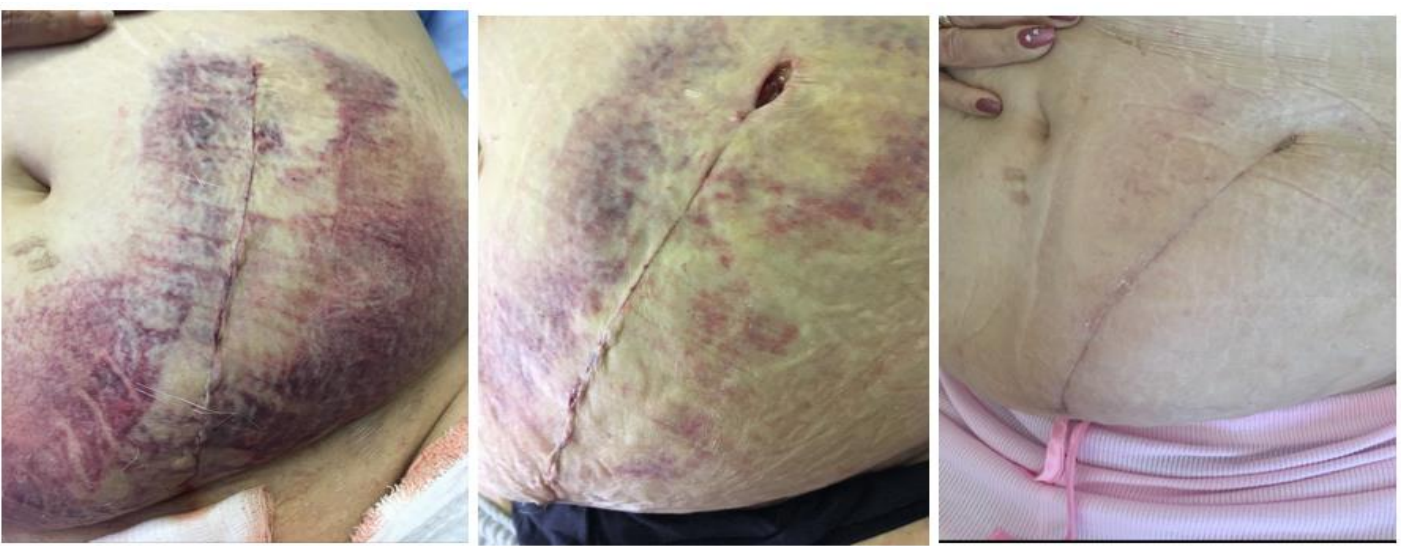


Fig 2. TED+IPC patient post-kidney transplantation. Wound images taken at 3, 5, and 30 post-operative day.



Fig 4. TED+IPC patient post-SKP transplantation. Wound images taken at 3, 5, and 30 post-operative day.

RESULTS

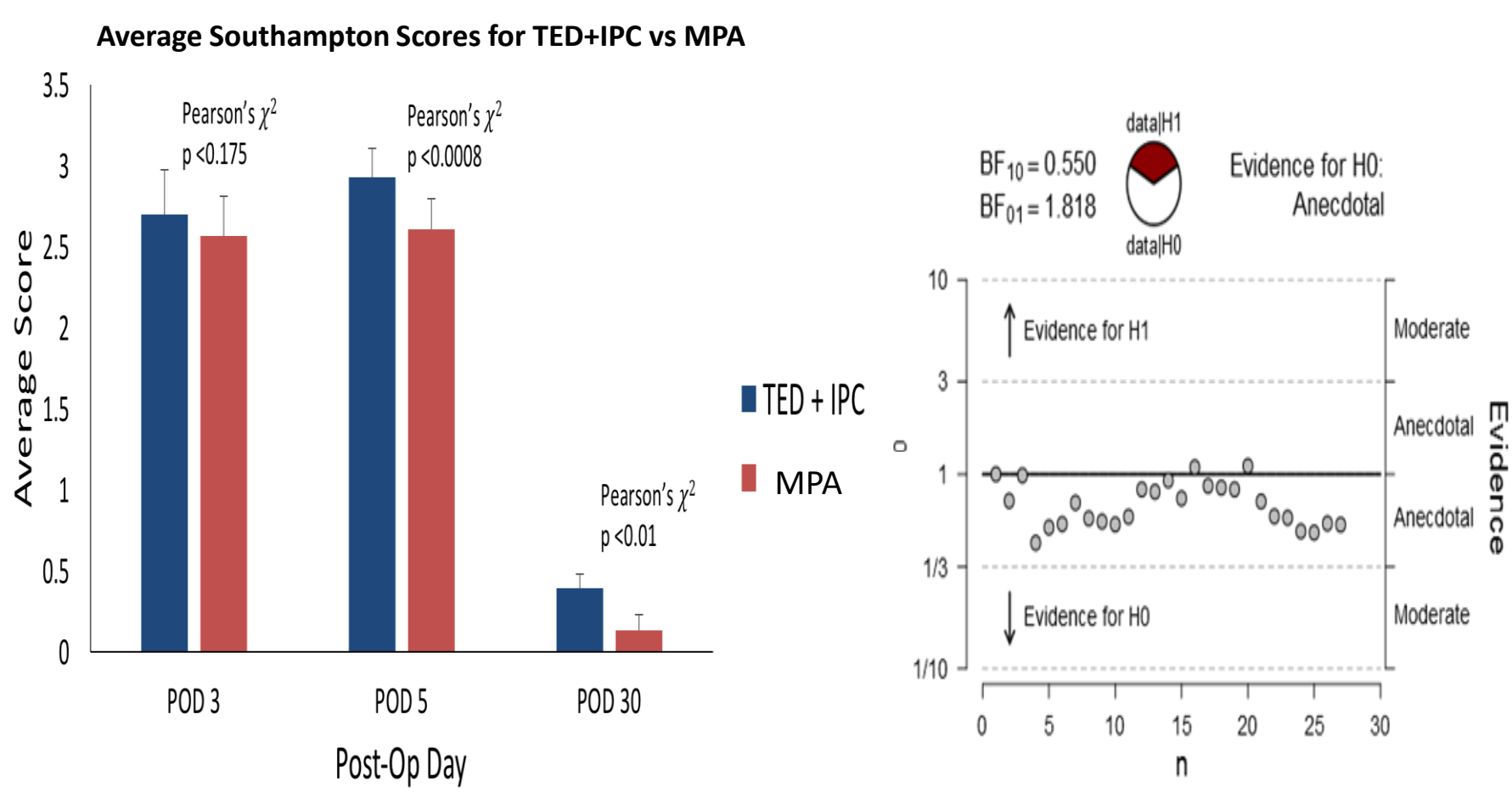


Fig 5. Average Southampton Wound Scores for TED + IPC vs MPA cohorts at post-operative days 3, 5, and 30.

At POD 3, there was no significant difference in wound score between the TED + IPC group and MPA group. (Pearson chi-square 4.1, P <0.175). At POD 5, the TED + IPC group had a significantly higher wound score compared to the MPA group. (Pearson chi-square 6.88, P < 0.0008). Similarly, at POD 30, the TED + IPC group had a significantly higher wound score compared to the MPA group. (Pearson chi-square 6.20, P < 0.01).

DISCUSSION

This is a level 1 evidence comparing standard TED + IPC treatment and the MPA device. It was observed that the use of the MPA device leads to a significant improvement in wound healing between POD 5 to POD 30 in kidney and SPK transplant patients, as compared with the standard treatment.

In the future, a multi-centre trial can affirm our experience. It may also be interesting to evaluate the impact that the MPA device on patient satisfaction. It is possible that the enhanced wound healing and comfort of the device in comparison with standard TEDs and IPCs may affect a patient's satisfaction on the care they are receiving. This could be performed by administering validated questionnaire to the patients that are proven to measure satisfaction.

CONCLUSION

The use of a MPA device in the immediate post-operative period leads to a significant improvement in early and late wound healing, and decreased number of complex wound infections following kidney and SPK transplantation compared to standard TED+IPC therapy.

Key Words

Muscle pump activator (MPA), Intermittent pneumatic compression (IPC), Thromboembolic deterrent (TED stockings), Simultaneous pancreas and kidney (SPK), Deep vein thrombosis (DVT).

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