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Full Length Article

Adherence to mechanical thromboprophylaxis after surgery: A systematic review and meta-analysis

Samantha Craigie [a,b], Johnson F. Tsui [c,d], Arnav Agarwal [a,e], Per Morten Sandset [f,g], Gordon H. Guyatt [a,h], Kari A.O. Tikkinen [i,j,*]

[a] Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, ON, Canada
[b] Michael G. DeGroote National Pain Centre, McMaster University, Hamilton, ON, Canada
[c] Department of Urology, North Shore-LIJ Lenox Hill Hospital, New York, NY, USA
[d] Institute for Prostate and Bladder Research, New York, NY, USA
[e] Faculty of Medicine, University of Toronto, Toronto, ON, Canada
[f] Department of Hematology, Oslo University Hospital, Oslo, Norway
[g] Institute of Clinical Medicine, University of Oslo, Oslo, Norway
[h] Department of Medicine, McMaster University, Hamilton, ON, Canada
[i] Department of Urology, Helsinki University Hospital and University of Helsinki, Helsinki, Finland
[j] Department of Public Health, University of Helsinki, Helsinki, Finland

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ABSTRACT

Background: Many clinical practice guidelines, while recommending mechanical thromboprophylaxis after surgery, have raised concerns that discomfort may result in nonadherence. We therefore addressed adherence to mechanical thromboprophylaxis after surgery.
Methods: We searched MEDLINE from January 1, 2000 to May 21, 2015 for English-language observational studies that assessed patient adherence to mechanical thromboprophylaxis after surgery. We conducted a meta-analysis to estimate average adherence rates.
Results: We identified 8 studies (7 for compression devices, 1 for stockings) with median follow up time of 3 days. The pooled estimate of adherence for compression devices was 75% (median 78%, range 40%-89%). Studies with shorter follow-up (≤3 days, n = 4, pooled adherence 75%) and longer follow-up (>3 days, n = 3, pooled adherence 75%) reported similar adherence ($p = 0.99$). The studies varied in definitions of adherence, frequency of assessment, length of follow-up and completeness of reporting. No study followed patients after discharge.
Conclusions: Up to one fourth of patients are nonadherent to mechanical thromboprophylaxis while hospitalized. Clinicians considering the relative merits of mechanical versus pharmacologic prophylaxis should address the issue of adherence. Strategies to improve adherence merit investigation.

1. Introduction

Venous thromboembolism (VTE), which includes deep vein thrombosis and pulmonary embolism, represents a serious, and on occasion fatal, complication of surgery [1,2]. Because randomized trials suggest that mechanical thromboprophylaxis may prevent postoperative VTE, and because they do not incur the bleeding risk associated with pharmacologic prophylaxis, clinical practice guidelines often recommend use of mechanical thromboprophylaxis after surgery [1,3]. In part as a result, these devices, which include elastic stockings and intermittent compression devices, are in wide use [1,2]. (See Table)

Effectiveness of mechanical prophylaxis requires, however, consistent use of the compression devices. Because the compression devices may sometimes be uncomfortable, guidelines have also raised concerns about nonadherence [1]. The extent to which patients comply with post-operative mechanical thromboprophylaxis is unclear, and no earlier systematic reviews of patient adherence exist. We therefore performed a systematic review of original studies that measured patient adherence to mechanical thromboprophylaxis after surgery in contemporary, real-life settings.

2. Material and Methods

We searched MEDLINE from Jan 1, 2000 to May 21, 2015 for English-language articles reporting on patient adherence to mechanical thromboprophylaxis (including stockings and compression devices) after surgery (see search strategy in Appendix). We included full-text

* Corresponding author at: Department of Urology, Helsinki University Hospital, Haartmaninkatu 4, 00029 Helsinki, Finland.
E-mail address: kari.tikkinen@gmail.com (K.A.O. Tikkinen).

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articles of observational studies that objectively assessed patient adherence to mechanical thromboprophylaxis after surgery. Eligible studies included patients recruited in or after the year 2000 undergoing surgery of any kind. We excluded intervention studies trying to directly impact adherence to mechanical thromboprophylaxis, randomized controlled trials (because adherence rates tend to be higher in randomized trials than in everyday clinical practice [4–6]), and studies that assessed adherence with more than one device. We accepted the definition of "adherence" used in each study, recognizing that there was heterogeneity in the definitions between studies. After extracting data on adherence from articles (independently and in duplicate using standardized forms), we pooled estimates of overall adherence. We pooled estimates in log-scale units across studies using DerSimonian and Laird's random effects model weighted by the inverse of the variance and then back transformed to the rate in natural units. A component of variance due to inter-study variation, D, was incorporated in the confidence interval calculation for the estimate. We employed pre-specified hypothesis to examine heterogeneity using meta-regression analysis weighted by the inverse of variance in random effects model. We addressed the possibility that heterogeneity in median adherence might be explained by lower adherence in studies with longer follow-up.

3. Results

Our search identified 221 reports (Fig. 1). Screening titles and abstracts and full texts yielded 8 eligible studies (Table). All studies were of surgical inpatients (median follow up time of 3 days); none included patients after discharge. Of the 8 studies, 4 (50%) enrolled only orthopedic surgery patients. The studies varied in their definitions of adherence, frequency of assessment, length of follow-up and completeness of reporting (Table). In 6 studies, investigators assessed adherence by periodic scheduled visits to the patients in which observers would note whether the patients were correctly using the devices [7,8,10,12–14]. In 2 studies, adherence was measured using a built-in meter that recorded the amount of time the device was in use [9,11]. We found 7 studies measuring adherence to compression devices and 1 study to compression stockings. (See Fig. 2.)

The pooled estimate of adherence for compression devices was 75% (median 78%, range 40%-89%). Across all reports on compression devices, there was no difference in adherence between studies with shorter follow-up (≤3 days, n = 4, pooled adherence 75%) and longer follow-up (>3 days, n = 3, pooled adherence 75%) ($p = 0.99$). The only study with elastic stockings reported adherence of 40%.

Fig. 1. Study flow chart.

Table
Characteristics of included studies.

Reference	Surgical population	# of patients	Mean age	Female (%)	Type of mechanical thromboprophylaxis[c]	Definition of adherence	No. of times/ day patients assessed	Mean days	Funding statement
Bockheim 2009 [7]	Multi[a]	150	62	49	Compression devices	Correctly in place, turned on, functioning	2	2	Not reported
Brady 2015 [14]	Obstetrics and gynecology	59	38	100	Compression devices	In bed, device applied, turned on, OR ambulating OR sitting	2	2.4	Not reported
Chan 2007 [8]	Orthopedic	30	72	Not reported	Compression devices	Correctly in place, turned on	3	7	Not reported
Froimson 2009 [9]	Orthopedic	1577	66	Not reported	Compression devices	Total minutes used divided by total minutes enrolled	Continuous	5.2	Authors reported study was unfunded
Parnaby 2004 [10]	Multi[b]	218	Not reported	Not reported	Stockings	Correctly in place	1	1	Not reported
Pitto 2008 [11]	Orthopedic	846	66	52	Compression devices	Total number of hours device was activated	Continuous	5	Not reported
Ritsema 2013 [12]	Urology	100	59	24	Compression devices	Correctly in place, turned on	2	2.8[d]	Authors reported study was unfunded
Westrich 2003 [13]	Orthopedic	100	Not reported	Not reported	Compression devices	Correctly in place, turned on, functioning	32	3	Not reported[e]

a: Trauma, joint replacement, cardiothoracic, orthopedic, vascular, spinal cord injury, head injury
b: "16 different mixed surgical specialty wards"
c: Compression devices include sequential compression devices, venous foot pumps, pneumatic compression devices
d: Calculated based on Fig. 1 of Ritsema et al.
e: Lead author serves as a consultant to and receives research support from the company that produces the devices in the article