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Evaluation of the Effectiveness of Venous Thromboembolism Prophylaxis in Patients Undergoing Major Urological Surgery

Pınar ONGUN¹, Sakir ONGUN²

¹ Balıkesir University, Faculty of Health Sciences, Department of Nursing

² Balıkesir University, Faculty of Medicine, Department of Urology

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ABSTRACT

Objective: To evaluate the effectiveness of venous thromboembolism prophylaxis in patients undergoing major urologic surgery. **Materials and Methods:** Data of patients who underwent major urological surgery between January 2018 and October 2023 were analyzed. Intraoperative age, body mass index, and comorbidities were recorded. All patients received prophylaxis with low molecular weight heparin and graduated compression stockings starting in the preoperative period until mobilization in the postoperative period. The patients' historical data were reviewed, and the development of venous thromboembolism in the one-month postoperative period was investigated. **Results:** Nephrectomy was performed in 156 patients (45.2%), radical prostatectomy in 142 patients (41.2%), partial nephrectomy in 28 patients (8.1%), and radical cystectomy in 19 patients (5.5%). The mean age at the time of operation was 66.06±9.43 years, and the body mass index was 27.06±4.22. Hypertension was found in 51.6%, diabetes mellitus in 26.1%, coronary artery disease in 13.9%, chronic obstructive pulmonary disease in 8.1%, atrial fibrillation in 2.1%, and valvular heart disease in 1.2%. In the postoperative period, two patients developed pulmonary embolism, and one patient developed deep vein thrombosis. One of the patients with pulmonary embolism had undergone radical prostatectomy, and the other patients had undergone radical cystectomy. There was no mortality after treatment. **Conclusion:** Venous thromboembolism is highly preventable when appropriate precautions and prophylaxis are taken. In our study, the incidence of pulmonary embolism and deep vein thrombosis was similar to the literature.

Keywords: Prophylaxis, Urological surgical procedures, Venous thromboembolism.

Majör Ürolojik Cerrahi Geçiren Hastalara Uygulanan Venöz Tromboemboli Profilaksisinin Etkinliğinin Değerlendirilmesi

ÖZ

Amaç: Araştırmada majör ürolojik cerrahi geçiren hastalara uygulanan venöz tromboemboli profilaksisinin etkinliğinin değerlendirilmesi amaçlandı. **Gereç Yöntem:** Ocak 2018 ve Ekim 2023 tarihleri arasında majör ürolojik cerrahi geçiren hastaların verileri incelendi. Hastaların operasyon sırasındaki yaşları, vücut kitle indeksleri, ek hastalıklarına dair veriler kaydedildi. Tüm hastalara postoperatif dönemde mobilize olana kadar preoperatif dönemde başlanarak düşük molekül ağırlıklı heparin ve dizüstü varis çorabı ile profilaksi uygulandı. Hastaların geçmiş verileri taranarak operasyon sonrası bir aylık periyotta venöz tromboemboli gelişip gelişmediği araştırıldı. **Bulgular:** Hastaların 156'sına (%45,2) nefrektomi, 142'sine (%41,2) radikal prostatektomi, 28 hastaya (%8,1) parsiyel nefrektomi ve 19 hastaya (%5,5) radikal sistektomi yapıldığı saptandı. Hastaların operasyon sırasındaki yaş ortalaması 66,06 ±9,43, vücut kitle indeksleri 27,06±4,22 olarak saptandı. Ameliyat edilen hastalarda %51,6 hipertansiyon, %26,1 Diyabetes Mellitus, %13,9 Koroner arter hastalığı, %8,1 Kronik obstrüktif akciğer hastalığı, %2,1 atriyal fibrilasyon, %1,2 kalp kapak hastalığı saptandı. Postoperatif dönemde 2 hastada pulmoner emboli ve 1 hastada derin ven trombozu geliştiği saptandı, pulmoner emboli gelişen hastalardan biri radikal prostatektomi, diğer hastalar ise radikal sistektomi operasyonu geçirmişti. Tedavi sonrası hastalarda mortalite gelişmedi. **Sonuç:** Venöz tromboembolizm uygun önlemler alınıp profilaksi uygulandığı zaman yüksek oranda önlenebilir bir durumdur. Çalışmamızda da pulmoner emboli ve derin ven trombozu görülme sıklığı literatür ile benzer olarak saptanmıştır. **Anahtar Kelimeler:** Profilaksi, Ürolojik cerrahi işlemler, Venöz tromboembolizm.

Sorumlu Yazar / Corresponding Author: Sakir ONGUN, Balıkesir University, Faculty of Medicine, Department of Urology, Balıkesir, Türkiye

E-mail: sakirongun@hotmail.com

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INTRODUCTION

Venous thromboembolism (VTE) is a vascular disease, including deep vein thrombosis and pulmonary embolism (PE), and is a severe complication of medical and surgical conditions (Al-Mugheed & Bayraktar, 2018; Oh et al., 2017). Risk factors include obesity, advanced age, immobilization (bed rest for more than four days), history of thrombotic events, inflammatory diseases, cancer, pregnancy, family history of VTE, smoking, estrogen treatments, and previous surgery (Irmak et al., 2022; Pastori et al., 2023). VTE prophylaxis aims to prevent VTE before it occurs in risky patient groups (Rice et al., 2010). VTE is a severe complication of urologic surgery and PE and one of the most common causes of death in patients undergoing major urologic surgery (Rice et al., 2010; Tikkinen et al., 2014). Although prophylaxis reduces mortality, thrombophylaxis also increases the risk of bleeding (Violette et al., 2016). Mechanical and/or pharmacologic methods can be used in VTE prophylaxis. Mechanical prophylaxis methods include graduated compression stockings, intermittent pneumatic compression, and foot compression devices (Al-Mugheed & Bayraktar, 2018). The most commonly used pharmacologic methods in urological surgeries include the use of unfractionated heparin and low molecular weight heparin (Rice et al., 2010). These methods can be applied alone or in combination according to the patient's risk factors and the operation to be performed (Kakkos et al., 2022; Nam et al., 2017). In patient groups where primary prophylaxis is inadequate or inappropriate, early diagnosis and treatment of VTE in the postoperative period is recommended (Tikkinen et al., 2014). Risk-adaptive prophylaxis is currently recommended in European Association of Urology (EAU) guidelines (Tikkinen et al., 2014). In this context, the aim of this study was to evaluate the effectiveness of VTE prophylaxis in major urologic surgeries.

MATERIALS AND METHODS

Study type

The retrospective study was conducted in the Urology clinic of a university hospital between 01.12.2023 and 01.02.2024.

Study group

The study population consisted of 345 patients who underwent major urologic surgery (Cystectomy, Nephrectomy, Partial Nephrectomy, Radical Prostatectomy) between 01.01.2018 and 31.10.2023. The data of 345 patients constituted the sample of the study.

Data collection

Microsoft Office Excel program was used for data collection. Information including age, gender, previous history of embolism, ASA classification, height, and weight were recorded. Data were collected through the MIA operating system used in

the hospital. Patients were divided into low, intermediate, and high-risk groups according to the risk-adjustment method recommended in the current EAU guidelines (Tikkinen et al., 2014).

Venous thromboembolism prophylaxis Standard practices were initiated in 2018, considering the guidelines published to prevent the development of VTE after major urologic surgery (Tikkinen et al., 2022). Mechanical and pharmacologic methods were applied to provide pre-and postoperative VTE prophylaxis in patients undergoing surgery.

- History was taken (previous VTE in the family and patient's history).
- Mechanical prophylaxis with graduated compression stockings was applied until mobilization in the postoperative period.
- The first mobilization in the postoperative period was performed between 8-16 hours postoperatively.
- Patients who developed VTE were followed up closely with Pulmonology, and anticoagulant therapy was administered at the appropriate dose.

Statistical analysis

The results were evaluated using the Statistics 25 program" (IBM SPSS- Statistical Package for the Social Sciences For Windows). The results were evaluated at a 95% confidence interval, and significance was assessed at $p < 0.05$. Number and percentage distribution, as well as mean and standard deviation, were used to analyze the data.

Ethical considerations

Ethics committee approval from Balikesir University and institutional permission from the institution where the research will be conducted were obtained (Date: 08.11.2023, Approval no: 2023/115). The principles of the Declaration of Helsinki conducted the study.

RESULTS

Nephrectomy was performed in 156 patients (45.2%), radical prostatectomy in 142 patients (41.2%), partial nephrectomy in 28 patients (8.1%), and radical cystectomy in 19 patients (5.5%). The mean age at the time of operation was 66.06 ± 9.43 years, and the body mass index was 27.06 ± 4.13 . Hypertension was found in 51.6%, diabetes mellitus in 26.1%, coronary artery disease in 13.9%, chronic obstructive pulmonary disease in 8.1%, atrial fibrillation in 2.1%, and valvular heart disease in 1.2%. The distribution of demographic data according to the operation performed is given in Table 1. VTE risk distribution of patients according to current EAU guidelines is shown in Table 2. In the postoperative period, two patients developed PE, and one patient developed deep vein thrombosis. One of the patients with PE had undergone radical prostatectomy, and the other patients had undergone radical cystectomy.

There was no mortality after appropriate treatment. Postoperative complications are given in Table 3.

Table 1. Distribution of demographic data according to the surgery performed on the patients.

Type of surgery \ Patient characteristics	Nephrectomy (n=156)	Radical prostatectomy (n=142)	Partial nephrectomy (n=28)	Radical cystectomy (n=19)	Major urological surgery (n=345)
Average age	64.74±11.44	67.59±5.51	62.75±11.05	70.37±8.99	66.06±9.43
BMI average	27.30±4.58	26.88±3.19	29.08±5.60	23.83±4.18	27.06±4.22
<25	49	39	4	12	104
25-29.9	60	79	17	5	161
30-34.9	40	21	4	2	67
≥35	7	3	3	0	13
Gender					
Female	53	0	12	3	68
Male	103	142	16	16	277
Chronic disease					
DM	42	32	10	6	90
Hypertension	80	66	13	8	167
KAH	20	20	5	3	48

Table 2. VTE risk model according to current EAU guidelines.

Risk classification	Risk	VTE probability	n	%
Low risk	Risk factor (-)	1x	284	82.3
Medium risk	One of the following risk factors; ➤ Age ≥ 75 ➤ BMI ≥ 35 ➤ VTE in 1st degree relatives (mother, father, sibling)	2x	48 11 0	17.2
High risk	Anamnesis of VTE ➤ Having 2 or more risk factors	4x	2	0.5

Table 3. Postoperative complications in patients.

Type of complication \ Type of surgery	n	Pulmonary embolism		Deep vein thrombosis		VTE	
		n	%	n	%	n	%
Nephrectomy	156	0	0	0	0	0	0
Radical prostatectomy	142	1	0.7	0	0	1	0.7
Partial nephrectomy	28	0	0	0	0	0	0
Radical cystectomy	19	1	5.2	1	5.2	2	10.5
Total	345	2	0.5	1	0.2	3	0.8

DISCUSSION

Urological surgeries, especially in the pelvic region, and restriction of mobility in the postoperative period increase the susceptibility to venous

thromboembolism. Venous thromboembolism is a preventable condition, and mortality can be reduced with early diagnosis and treatment.

There is a trade-off between bleeding risk and VTE risk reduction when deciding on pharmacologic prophylaxis in urologic surgery (Forrest et al., 2009; Tikkinen et al., 2014; Violette et al., 2016). High-grade evidence suggests that 50% of postoperative bleeding occurs in the first 24 hours and 90% in the first 4 days, while VTE occurs in the first 4 weeks postoperatively (Amin et al., 2011; Devereaux et al., 2014; Sweetland et al., 2009; Tikkinen et al., 2014). For this reason, there are various protocols in terms of the timing of pharmacologic prophylaxis, such as preoperative, preoperative+first 7 days, starting 24 hours postoperatively, and prophylaxis for 7 days, or prophylaxis for 30 days (Sertkaya et al., 2014; Shakiba et al., 2024). EAU guidelines suggest that it may be appropriate to start pharmacologic prophylaxis after 24 hours postoperatively (Tikkinen et al., 2022). However, preoperative administration of the first dose significantly reduces VTE (Reinke et al., 2012). Currently, there is no randomized controlled trial in the literature comparing the timing of administration of pharmacological prophylaxis. In this study, patients received pharmacologic prophylaxis in the preoperative period 12 hours before the operation. The rate of VTE is 1% in 196,915 patients who underwent major urological surgery, which was found to be 0.8% in this study, and our complication rates are similar to the current literature (Cano Garcia et al., 2023).

Another type of thrombophylaxis is mechanical prophylaxis. Meta-analyses have found that mechanical prophylaxis reduces the risk of VTE by 50% (Tikkinen, Craigie, Agarwal, Siemieniuk, et al., 2018; Tikkinen, Craigie, Agarwal, Violette, et al., 2018). Graduated compression stockings, intermittent pneumatic compression, and foot compression devices are used in mechanical prophylaxis (Al-Mugheed & Bayraktar, 2018). These methods should be used alone or with pharmacologic prophylaxis (Kakkos et al., 2022; Nam et al., 2017). One of the most commonly used types is graduated compression stockings, which protect from venous stasis by regulating venous flow (Speth, 2023). Patient compliance is essential in these applications; some patients may develop skin wounds, ulcers, discomfort, and perineuronal nerve palsy (Speth, 2023). All patients included in this study received above-knee graduated compression stockings as mechanical prophylaxis. Patient treatment compliance may also be influential in the low incidence of VTE.

The incidence of VTE and PE after urologic surgeries is 0.2-7.8% and 0.2-7%, respectively (Rice et al., 2010). Various risk factors for VTE have been defined as preoperative, intraoperative, and postoperative. Conditions such as advanced age, obesity, malignancy, history of VTE, and DM are some of the preoperative risk factors; conditions such as prolonged operation, blood loss, and reoperation are intraoperative; immobility, sepsis, and MI are

some of the postoperative risk factors (Irmak et al., 2022; Pastori et al., 2023).

The Caprini risk score is the most commonly used and validated score to estimate VTE risks, but its detailed patient information poses challenges for urologists to use in clinical practice (Golemi et al., 2019). Urologists prefer to use patient-based risk classifications, which are simpler, faster, and valid, as recommended by the EAU (Tikkinen et al., 2014). In this study, 82% of patients were in the low-risk group, 17% in the intermediate-risk group, and 0.5% in the high-risk group.

Although pharmacologic prophylaxis generally covers the first postoperative week, extended prophylaxis covering 30 days postoperatively is recommended for high-risk patients undergoing major pelvic surgery (Rausa et al., 2018). According to four retrospective studies and one population-based cohort study on radical cystectomy, the major urological surgery with the highest morbidity and mortality, postoperative mortality was 2.1-3.2% in the first 30 days and 3.4-8.0% in the first 90 days (Bochner et al., 2015; Mossanen et al., 2019). A study that included approximately 14,000 radical cystectomy patients showed that VTE and PE rates were 2.6% and 1.2% after radical cystectomy, respectively (Cano Garcia et al., 2023). This study's rate was 10.5% for VTE and 5.2% for PE. This difference in the literature may be related to the duration of pharmacologic prophylaxis. Extended prophylaxis seems to be advantageous for radical cystectomy patients and open radical prostatectomy patients (Naik et al., 2019). Current EAU guidelines recommend mechanical and pharmacologic prophylaxis for all radical cystectomy patients regardless of risk group (Tikkinen et al., 2022).

While VTE rates after open radical prostatectomy vary between 0.9% and 15.7%, this rate can be as low as 0.2% in robotic radical prostatectomy (Cano Garcia et al., 2023; Chen et al., 2016; Naik et al., 2019). Although extended prophylaxis after radical prostatectomy appears to be safe and effective, tolerance to mechanical prophylaxis is low (Cindolo et al., 2009). EAU guidelines recommend mechanical and pharmacologic prophylaxis in open radical prostatectomy (Tikkinen et al., 2022). Suppose radical prostatectomy is to be performed robotically or laparoscopically. In that case, mechanical prophylaxis remains constant in EAU recommendations, but pharmacologic prophylaxis varies according to the patient's risk and whether lymph node dissection will be performed (Tikkinen et al., 2022).

Patients in this study underwent open radical prostatectomy and developed VTE and PE at a rate of 0.7%, similar to the literature (Cano Garcia et al., 2023). After radical nephrectomy, VTE is observed at a rate of 1.1% and PE at 0.5% (Cano Garcia et al., 2023). After partial nephrectomy, the rate of VTE is 0.6%, and PE is 0.4% (Cano Garcia et al., 2023).

Pharmacologic prophylaxis after partial nephrectomy may be risky in terms of postoperative bleeding (Rice et al., 2010). A recent study found that pharmacologic prophylaxis administered once preoperatively in partial nephrectomy patients did not increase bleeding but did not change the risk of a VTE (Dai et al., 2021). EAU guidelines recommend mechanical and pharmacologic prophylaxis in open radical and partial nephrectomy (Tikkinen et al., 2022). If these surgical procedures are to be performed robotically or laparoscopically, mechanical prophylaxis remains constant in EAU recommendations, but pharmacologic prophylaxis varies according to the patient's risk (Tikkinen et al., 2022). In our study, VTE and PE did not develop in patients who underwent nephrectomy and partial nephrectomy due to the small number of patients available, considering the low incidences in the literature for these operations.

Limitations and Strengths

One of the limitations of the study is that it was retrospective. Another limitation is that unlike most of the studies in the literature, preoperative single-dose pharmacologic prophylaxis was applied, which limits the comparisons with the literature.

CONCLUSION

Mechanical and pharmacologic methods were applied in VTE prophylaxis, which was determined according to risk status in patients undergoing major urologic surgery. It was found that only 0.8% of patients developed VTE. With this result, it is predicted that the development of VTE can be prevented by risk assessment, selection of appropriate prophylaxis methods, and early mobilization.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: PO; **Material, methods and data collection:** PO, SO; **Data analysis and comments:** PO, SO; **Writing and corrections:** PO, SO.

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Ethical Approval

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REFERENCES

- Al-Mugheed, K. A., & Bayraktar, N. (2018). Knowledge and practices of nurses on deep vein thrombosis risks and prophylaxis: a descriptive cross sectional study. *Journal of Vascular Nursing : Official Publication of the Society for Peripheral Vascular Nursing*, 36(2), 71–80. <https://doi.org/10.1016/J.JVN.2018.02.001>
- Amin, A. N., Lenhart, G., Prinicic, N., Lin, J., Thompson, S., & Johnston, S. (2011). Retrospective administrative database study of the time period of venous thromboembolism risk during and following hospitalization for major orthopedic or abdominal surgery in real-world US patients. *Hospital Practice (1995)*, 39(2), 7–16. <https://doi.org/10.3810/HP.2011.04.390>
- Bochner, B. H., Dalbagni, G., Sjoberg, D. D., Silberstein, J., Keren Paz, G. E., Donat, S. M. H., Coleman, J. A., Mathew, S., Vickers, A., Schnorr, G. C., Feuerstein, M. A., Rapkin, B., Parra, R. O., Herr, H. W., & Laudone, V. P. (2015). Comparing open radical cystectomy and robot-assisted laparoscopic radical cystectomy: a randomized clinical trial. *European Urology*, 67(6), 1042–1050. <https://doi.org/10.1016/J.EURURO.2014.11.043>
- Cano Garcia, C., Tappero, S., Piccinelli, M. L., Barletta, F., Incesu, R. B., Morra, S., Scheipner, L., Baudo, A., Tian, Z., Hoeh, B., Chierigo, F., Sorce, G., Saad, F., Shariat, S. F., Carmignani, L., Ahyai, S., Longo, N., Tilki, D., Briganti, A., ... Karakiewicz, P. I. (2023). In-hospital venous thromboembolism and pulmonary embolism after major urologic cancer surgery. *Annals of Surgical Oncology*, 30(13), 8770–8779. <https://doi.org/10.1245/S10434-023-14246-0/TABLES/5>
- Chen, E. C., Papa, N., Lawrentschuk, N., Bolton, D., & Sengupta, S. (2016). Incidence and risk factors of venous thromboembolism after pelvic uro-oncologic surgery—a single center experience. *BJU International*, 117, 50–53. <https://doi.org/10.1111/BJU.13238>
- Cindolo, L., Salzano, L., Mirone, V., Imbimbo, C., Longo, N., Kakkos, S. K., & Reddy, D. J. (2009). Thromboprophylaxis in radical retropubic prostatectomy: efficacy and patient compliance of a dual modality. *Urologia Internationalis*, 83(1), 12–18. <https://doi.org/10.1159/000224861>
- Dai, J. C., Morgan, T. N., Kusin, S., Kommidi, V., Garbens, A., Cadeddu, J. A., & Gahan, J. C. (2021). Use of pre-operative pharmacologic venous thromboembolism prophylaxis for robotic partial nephrectomy. *Urology*, 154, 177–183. <https://doi.org/10.1016/J.UROLOGY.2021.03.043>

- Devereaux, P. J., Mrkobrada, M., Sessler, D. I., Leslie, K., Alonso-Coello, P., Kurz, A., Villar, J. C., Sigamani, A., Biccard, B. M., Meyhoff, C. S., Parlow, J. L., Guyatt, G., Robinson, A., Garg, A. X., Rodseth, R. N., Botto, F., Lurati Buse, G., Xavier, D., Chan, M. T. V., ... Yusuf, S. (2014). Aspirin in patients undergoing noncardiac surgery. *The New England Journal of Medicine*, *370*(16), 1494–1503. <https://doi.org/10.1056/NEJM0A1401105>
- Forrest, J. B., Clemens, J. Q., Finamore, P., Leveillee, R., Lippert, M., Pisters, L., Touijer, K., & Whitmore, K. (2009). AUA best practice statement for the prevention of deep vein thrombosis in patients undergoing urologic surgery. *The Journal of Urology*, *181*(3), 1170–1177. <https://doi.org/10.1016/J.JURO.2008.12.027>
- Golemi, I., Salazar Adum, J. P., Tafur, A., & Caprini, J. (2019). Venous thromboembolism prophylaxis using the caprini score. *Disease-a-Month: DM*, *65*(8), 249–298. <https://doi.org/10.1016/J.DISAMONTH.2018.12.005>
- Irmak, B., Karadag, M., & Yildiz Emre, N. (2022). The risk factors for preoperative and postoperative deep vein thrombosis in surgical patients. *Clinical and Experimental Health Sciences*, *12*, 120–127. <https://doi.org/10.33808/clinexphealthsci.839430>
- Kakkos, S., Kirkilesis, G., Caprini, J. A., Geroulakos, G., Nicolaides, A., Stansby, G., & Reddy, D. J. (2022). Combined intermittent pneumatic leg compression and pharmacological prophylaxis for prevention of venous thromboembolism. *The Cochrane Database of Systematic Reviews*, *1*(1). <https://doi.org/10.1002/14651858.CD005258.PUB4>
- Mossanen, M., Krasnow, R. E., Zlatev, D. V., Tan, W. S., Preston, M. A., Trinh, Q. D., Kibel, A. S., Sonpavde, G., Schrag, D., Chung, B. I., & Chang, S. L. (2019). Examining the relationship between complications and perioperative mortality following radical cystectomy: a population-based analysis. *BJU International*, *124*(1), 40–46. <https://doi.org/10.1111/BJU.14636>
- Naik, R., Mandal, I., Hampson, A., Lane, T., Adshead, J., Rai, B. P., & Vasdev, N. (2019). The role of extended venous thromboembolism prophylaxis for major urological cancer operations. *BJU International*, *124*(6), 935–944. <https://doi.org/10.1111/BJU.14906>
- Nam, J. H., Kim, D. H., Yoo, J. H., Hwang, J. H., & Chang, J. D. (2017). Does preoperative mechanical prophylaxis have additional effectiveness in preventing postoperative venous thromboembolism in elderly patients with hip fracture?-Retrospective case-control study. *PLoS One*, *12*(11). <https://doi.org/10.1371/JOURNAL.PONE.0187337>
- Oh, H., Boo, S., & Lee, J. A. (2017). Clinical nurses' knowledge and practice of venous thromboembolism risk assessment and prevention in South Korea: a cross-sectional survey. *Journal of Clinical Nursing*, *26*(3–4), 427–435. <https://doi.org/10.1111/JOCN.13424>
- Pastori, D., Cormaci, V. M., Marucci, S., Franchino, G., Del Sole, F., Capozza, A., Fallarino, A., Corso, C., Valeriani, E., Menichelli, D., & Pignatelli, P. (2023). A Comprehensive Review of Risk Factors for Venous Thromboembolism: From Epidemiology to Pathophysiology. *International Journal of Molecular Sciences*, *24*(4). <https://doi.org/10.3390/IJMS24043169>
- Rausa, E., Kelly, M. E., Asti, E., Aiolfi, A., Bonitta, G., Winter, D. C., & Bonavina, L. (2018). Extended versus conventional thromboprophylaxis after major abdominal and pelvic surgery: systematic review and meta-analysis of randomized clinical trials. *Surgery*, *164*(6), 1234–1240. <https://doi.org/10.1016/J.SURG.2018.05.028>
- Reinke, C. E., Drebin, J. A., Kreider, S., Kean, C., Resnick, A., Raper, S., & Kelz, R. R. (2012). Timing of preoperative pharmacoprophylaxis for pancreatic surgery patients: a venous thromboembolism reduction initiative. *Annals of Surgical Oncology*, *19*(1), 19–25. <https://doi.org/10.1245/S10434-011-1858-1/TABLES/4>
- Rice, K. R., Brassell, S. A., & McLeod, D. G. (2010). Venous thromboembolism in urologic surgery: prophylaxis, diagnosis, and treatment. *Reviews in Urology*, *12*(2–3), e111. <https://doi.org/10.3909/riu0472>
- Sertkaya, Z., & Öztürk, M. (2014). Ürolojik Cerrahilerde Venöz Tromboembolizm. *Endouroloji Bulteni*, *135-138*. <https://doi.org/10.530/endo2014070307>
- Shakiba, B., Faegh, A., Emami, S., Heidari, K., & Maghsoudi, R. (2024). Procedure-Specific Thromboprophylaxis in urological surgeries: a narrative review. *Urology Journal*. <https://doi.org/10.22037/UJ.V20I.8068>
- Speth, J. (2023). Guidelines in practice: prevention of venous thromboembolism. *AORN Journal*, *118*(5), 321–328. <https://doi.org/10.1002/AORN.14019>
- Sweetland, S., Green, J., Liu, B., De González, A. B., Canonico, M., Reeves, G., & Beral, V. (2009). Duration and magnitude of the postoperative risk of venous thromboembolism in middle aged women: prospective cohort study. *British Medical Journal (Clinical Research Ed.)*, *339*(7736), 32. <https://doi.org/10.1136/BMJ.B4583>
- Tikkinen, K. A. O., Agarwal, A., Craigie, S., Cartwright, R., Gould, M. K., Haukka, J., Naspro, R., Novara, G., Sandset, P. M., Siemienuk, R. A., Violette, P. D., & Guyatt, G. H. (2014). Systematic reviews of observational studies of risk of thrombosis and bleeding in urological surgery (ROTBUS): introduction and methodology. *Systematic Reviews*, *3*(1). <https://doi.org/10.1186/2046-4053-3-150>
- Tikkinen, K. A. O., Cartwright, R., Gould, M. K., Naspro, R., Novara, G., Sandset, P. M., Violette, P. D., & Guyatt, G. H. (2022). *EAU guidelines on thromboprophylaxis in urological surgery*. <https://uroweb.org/eau-guidelines/discontinued-topics/thromboprophylaxis>

- Tikkinen, K. A. O., Craigie, S., Agarwal, A., Siemieniuk, R. A. C., Cartwright, R., Violette, P. D., Novara, G., Naspro, R., Agbassi, C., Ali, B., Imam, M., Ismaila, N., Kam, D., Gould, M. K., Sandset, P. M., & Guyatt, G. H. (2018). Procedure-specific risks of thrombosis and bleeding in urological non-cancer surgery: systematic review and meta-analysis. *European Urology*, *73*(2), 236–241. <https://doi.org/10.1016/J.EURURO.2017.02.025>
- Tikkinen, K. A. O., Craigie, S., Agarwal, A., Violette, P. D., Novara, G., Cartwright, R., Naspro, R., Siemieniuk, R. A. C., Ali, B., Eryuzlu, L., Geraci, J., Winkup, J., Yoo, D., Gould, M. K., Sandset, P. M., & Guyatt, G. H. (2018). Procedure-specific risks of thrombosis and bleeding in urological cancer surgery: systematic review and meta-analysis. *European Urology*, *73*(2), 242–251. <https://doi.org/10.1016/J.EURURO.2017.03.008>
- Violette, P. D., Cartwright, R., Briel, M., Tikkinen, K. A. O., & Guyatt, G. H. (2016). Guideline of guidelines: thromboprophylaxis for urological surgery. *BJU International*, *118*(3), 351–358. <https://doi.org/10.1111/BJU.13496>