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Risk factors for postoperative hematoma after inguinal hernia repair: an update

*Muhammad H. Zeb, MBBS, T.K. Pandian, MD, Moustafa M. El Khatib, MBBCh, Nimesh D. Naik, MD, Abhishek Chandra, David S. Morris, MD, Rory L. Smoot, MD, and David R. Farley, MD**

Division of Subspecialty General Surgery, Mayo Clinic College of Medicine, Rochester, Minnesota

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ABSTRACT

Background: We recently sensed an increase in the frequency of groin hematoma after inguinal hernia repair (IHR) at our institution. The aim of this study was to provide a more updated assessment of the risk factors inherent to this complication.

Methods: We performed a case-control study of all adult patients (age ≥ 18 y) who developed a groin hematoma after IHR at our institution between 2003 and 2015. Univariate and multivariable analyses were performed to assess for independent predictors for groin hematoma.

Results: A total of 96 patients (among 6608 IHR) developed a groin hematoma, (60 were observed, 36 required intervention). The hematoma frequency increased from our previous study (1.4 % *versus* 0.9%, $P < 0.01$). Mean age was 64.6 y (range: 18-92), and 84.3% were men. There was no significant difference in the laterality, type, or technique of IHR between cases and controls. Univariate analysis (odds ratio [95% confidence interval], *P*) identified warfarin usage (3.5, [1.6-6.4], $P < 0.01$), valvular heart disease (11.6, [2.6-51.3], $P < 0.01$), atrial fibrillation (2.6, [1.2-5.5], $P = 0.01$), hypertension (2.03, [1.1-3.6], $P = 0.02$), recurrent hernia (3.7, [1.4-9.7], $P < 0.01$), and coronary artery disease (2.1, [1.0-4.4], $P = 0.05$) as significant preoperative factors. The proportion of patients on warfarin decreased since our prior report (31% *versus* 42%, $P = 0.20$). On multivariable regression, warfarin and recurrent hernia were independent predictors of hematoma development.

Conclusions: Independent risk factors for the development of groin hematoma after IHR included warfarin use and recurrent hernia. Careful consideration for anticoagulation and surgical hypervigilance remains prudent in all patients undergoing IHR and especially those with recurrence.

Introduction

Inguinal hernia repair (IHR) is one of the most common surgical procedures worldwide. In the United States alone, approximately 800,000 repairs are performed annually.[1] Groin hematoma after IHR is an infrequent complication that can cause significant patient discomfort, require reoperation, and delay postoperative recovery. Several studies reveal that postoperative groin hematomas after IHR occur with a frequency between 0.3% and 6%.[2-8] We have previously reported

* *Corresponding author*. Department of Surgery, Mayo Clinic, 200 First Street, SW, Rochester, MN 55905. Tel.: +1 507 284 2095; fax: +1 507 284 5196.
E-mail address: farley.david@mayo.edu (D.R. Farley).
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an increase in hematoma occurrence in patients who were on warfarin therapy undergoing IHR.[7] A concern has always existed regarding the risk of bleeding associated with cessation and resumption of anticoagulation after surgery. Earlier studies have focused on anticoagulation as an important predictor of groin hematoma but have not provided much detail regarding optimal bridging therapy.[8-10] Whether bridging with heparin is a contributor to hematoma remains unclear, but a recent randomized study has suggested that bridging triples the risk of bleeding.[11]

In addition to established coagulation abnormalities, other possible contributors to hematoma formation may include hernia location, recurrence, or incarceration.[12] Laparoscopic hernia repair has been proven to have faster recovery and earlier return to work compared with Lichtenstein repair and is the treatment of choice in many patients.[13,14] As older surgeons adopt the laparoscopic approach, rates of hematoma may increase as they work upward along the necessary learning curve.[15] Herein, we aim to review our experience with groin hematoma after IHR, update our results as previously published, and further analyze risk factors unrelated to anticoagulation.

Methods

Cases and controls

Under institutional review board approval, all adults (age $\geq$ 18 y) at our institution who developed a groin hematoma after IHR between the years 2003 and 2015 were studied. These patients were identified using the morbidity and mortality lists for all general surgeons operating at our institution. Morbidity and mortality lists at our institution are generated by each surgical team as complications occur. Despite this "rolling" submission, it is certainly possible that subclinical hematomas not requiring any diagnostic modality or intervention may not have been included in the list. Cases were defined as the patients who developed groin hematoma, confirmed by computed tomography scan or ultrasound, within 30 d of the procedure. To avoid overestimation of hematoma occurrence, patients with clinical findings such as ecchymoses and a mass were not included unless imaging confirmed the diagnosis. Controls were obtained by using surgical indexing to identify all patients who had undergone IHR at our institution during the study years and cross-referencing this with the morbidity and mortality lists to remove those that developed hematoma. Thereafter, each case was matched by age (at the time of repair) and gender in 1:1 fashion. Time of operation for matched cases and controls was within 1 y or less to attempt to match for the period of presentation. This sample size provided approximately 80% power to detect a relative risk of $\geq$3.0.

Data extraction

Both patient (cases and controls) and procedure characteristics were obtained including age, gender, date of repair, type of hernia (direct, indirect or both), defect laterality, hernia recurrence, incarceration, type of repair performed, date of hematoma formation, concomitant medications (warfarin, heparin, aspirin, clopidogrel), use of perioperative bridging with heparin, and anticoagulation restart time frame. In addition, patient medical conditions including presence of cardiac valvular disease, atrial fibrillation, cerebral vascular disease, hypertension, hyperlipidemia, coronary artery disease, pulmonary embolism, hematologic abnormalities (leukemia, polycythemia, and thrombocytopenia) and evidence of previous bleeding were evaluated.

Statistical analysis

Univariate analysis was initially used to identify patient and operative characteristic differences between cases and controls. To analyze matched data with a binary outcome, a conditional logistic regression model was used. This model was created so that the proportional hazards for each case and associated matched control were in a separate stratum. The odds ratios (ORs) from these models were reported with 95% confidence intervals (CIs). Multivariable models were then built using stepwise, backward, and best subset selection. All tests were two sided with a significance level of 0.05. All analyses were conducted with SPSS (Statistics for Windows, IBM Corp, Released 2011, version 20.0, Armonk, NY).

Results

A total of 96 cases (1.4%) of postoperative hematoma after IHR were identified from 6608 hernia repair operations (Table 1). The mean age for cases and controls was 64.6 y (±17.1), and 84.3% were men. There was no significant difference between the cases and controls in terms of hernia laterality (left, right, bilateral; $P = 0.85$, usage of aspirin [$P = 0.15$], usage of clopidogrel [$P = 1.00$], and hyperlipidemia [$P = 0.19$]). Furthermore, both groups were comparable in regard to hernia repair technique ($P = 0.58$; Table 2). The mean time to hematoma formation and/or recognition was postoperative day (POD) 4.7 (±3.8).

Table 1 – Number of hematomas and hernias performed per year 2003-2015.

Year	Hernia repairs	Hematomas	%
2003	566	5	0.8
2004	598	9	1.5
2005	542	10	1.8
2006	506	8	1.5
2007	478	5	0.8
2008	564	6	1.0
2009	588	3	0.5
2010	549	7	1.2
2011	565	7	1.2
2012	472	11	2.3
2013	597	7	1.1
2014	523	12	2.2
2015	174	5	2.8
Total	**6608**	**96**	**1.4**