Surgery
UNIVERSITY OF TORONTO

Alternative anticoagulants in heparin-sensitive patients undergoing aortic interventions: A scoping review

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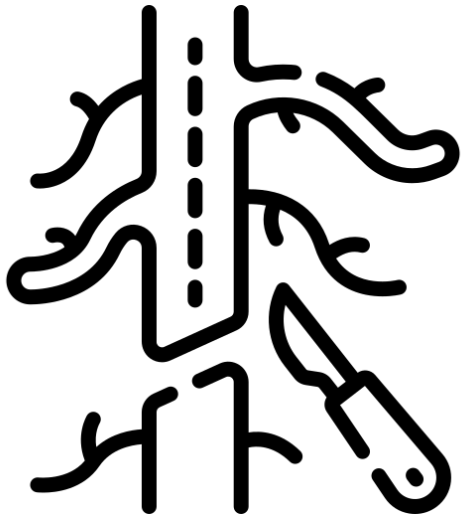
Introduction

- Heparin is the preferred procedural anticoagulant in cardiovascular surgery
- Hypersensitivities exist: Type I (rare), II (HIT; most dangerous) & IV (most common)[1,2]
- HIT incidence in EVAR is 0.22% and 0.53% in open AAA repair[3]
- Effective use of non-heparin alternatives has been demonstrated for ascending, arch, and thoracic aortic repair with CPB but what about descending aortic interventions without CPB?[4-10]

Objective

To evaluate the use of non-heparin anticoagulants in open and endovascular aortic interventions on the descending thoracic and abdominal aorta



Flaticon

Methods

- **Study Design:** Scoping Review
- **Databases Searched:** PubMed, OVID Medline, Embase
- **Studies Sought:** Primary literature
- **Timeframe:** 1993-2025
- **Outcome:** Incidence of postoperative complications
- **Exclusion Criteria:** Use of CPB/ECMO, postoperative treatment of heparin hypersensitivity, non-surgical anticoagulation therapy for DIC

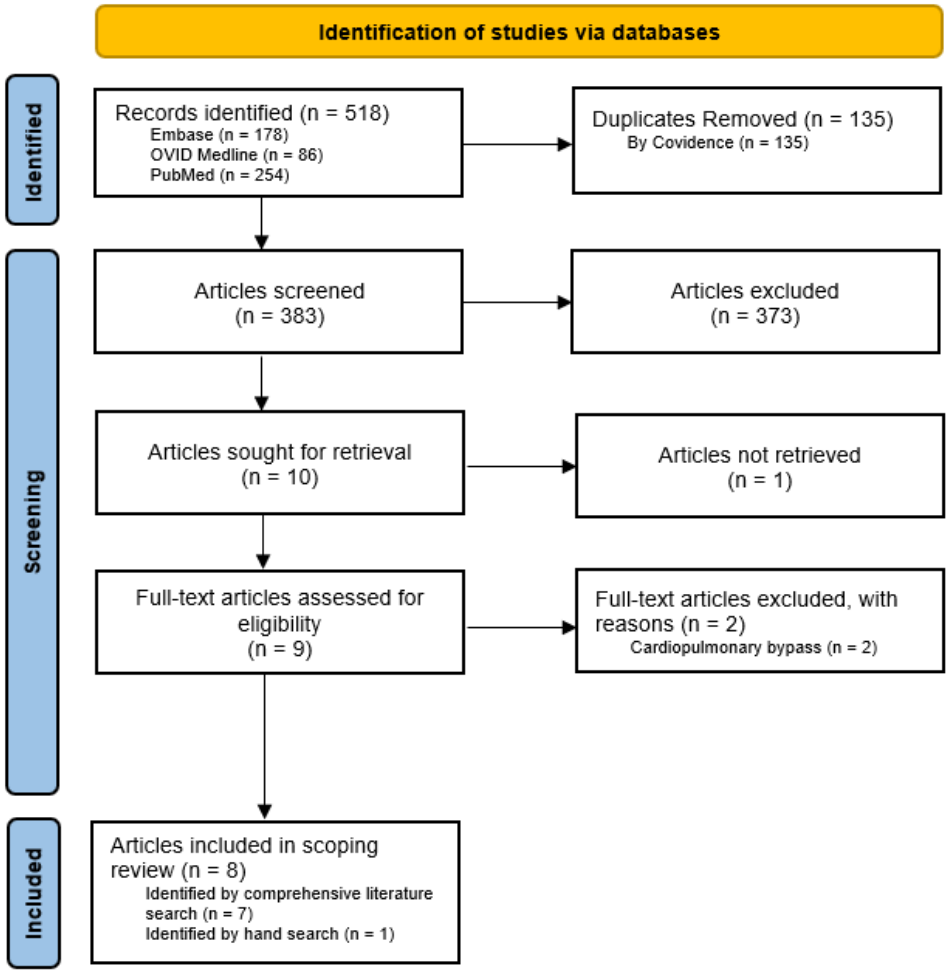
PRISMA

PubMed

Embase®

Ovid®

Results


Identification of studies via databases
Identified
Records identified (n = 518)
Embase (n = 178)
OVID Medline (n = 86)
PubMed (n = 254)
Duplicates Removed (n = 135)
By Covidence (n = 135)
Screening
Articles screened
(n = 383)
Articles excluded
(n = 373)
Articles sought for retrieval
(n = 10)
Articles not retrieved
(n = 1)
Full-text articles assessed for eligibility
(n = 9)
Full-text articles excluded, with reasons (n = 2)
Cardiopulmonary bypass (n = 2)
Included
Articles included in scoping review (n = 8)
Identified by comprehensive literature search (n = 7)
Identified by hand search (n = 1)

Direct Thrombin Inhibitors

No adverse effects associated with use; comparative RCS reported a lower overall and major complication rate with bivalirudin (n=5)

Author (Year)	Study Type	Number of Patients (n)	Anticoagulant	Intervention	Complications
Koster et al (2000)	Case Report	1 (67 y.o. female w/ HIT)	r-Hirudin	Open AAA Repair	➢ None (discharged POD 10)
Katzen et al (2005)	RCS	7	Bivalirudin	EVAR	➢ No mortality ➢ No major bleeding
Hueser & Patel (2007)	Case Report (as Letter-to-Editor)	1 (77 y.o. male w/ HIT)	Argatroban	Open AAA Repair	➢ None
Stamler et al (2009)	RCS	740	Bivalirudin: 98 UFH: 642	EVAR	➢ Total Complications: 21.4% bivalirudin vs. 38.5% UFH, p = 0.001 ➢ Major Complications – Grade 0: 78.6% bivalirudin vs. 61.5% UFH, p = 0.001; ➢ Major Complications – Grade 1: 12.2% bivalirudin vs. 25.2% UFH, p = 0.0046 ➢ Major Complications – Grade 2: 7.1% bivalirudin vs. 9.3% UFH, p = 0.57 ➢ Major Complications – Grade 3: 2.0% bivalirudin vs. UFH 4.0%, p = 0.57 ➢ Major Bleeding: 10.2% bivalirudin vs. 14.2% UFH, p = 0.34 ➢ Minor Bleeding: 12.2% bivalirudin vs. 14.0% UFH, p = 0.75
Png et al (2023)	Case Report	1 (65 y.o. male w/ HIT)	Argatroban	FEVAR Revision	➢ Severe opiate-associated constipation (discharged POD 9)

Heparin Derivatives

Associated with higher complication rates; RCT demonstrated that LMWH trended toward increased complications and case reports described adverse events necessitating discontinuation (n=3)

Author (Year)	Study Type	Number of Patients (n)	Anticoagulant	Intervention	Complications
Alimi et al (1996)	RCT	44	UFH: 6 LMWH (Nadroparin): 38	Aortic Aneurysm: 26 Aortoiliac Occlusive Disease: 18	➢ Mortality: 2.6% nadroparin vs. 0% UFH ➢ Major Bleeding: 2.6% nadroparin vs. 0% UFH ➢ Minor Bleeding: 23.7% nadroparin vs. 0% UFH ➢ Venous Thrombosis: 2.6% nadroparin vs. 0% UFH ➢ No Arterial Thrombosis
Karkos & Mandala (2010)	Case Report (as Letter-to-Editor)	1	LMWH (Enoxaparin)	Aortoiliac Thromboembolectomy & Infrarenal Aortoiliac Stenting	➢ Switched to fondaparinux postoperatively for LMWH-induced HIT; patient remains well 3 years later
Canaud et al (2013)	Case Report	1 (72 y.o. male w/ HIT)	Danaparoid	EVAR Stent-Graft Explantation, Thrombectomy & Open AAA Repair	➢ None prior to discharge on POD 10; presented POD 20 with thrombocytopenia & subacute limb ischemia due to thrombosis thought to be the result of unconfirmed cross-reactivity of danaparoid

Conclusion

Therapeutic Algorithm	Justification	
Bivalirudin → Argatroban	DTIs: Appear to be a SAFE ALTERNATIVE with bivalirudin demonstrating a lower incidence of perioperative complications	Bivalirudin > Argatroban: • Faster clearance • Safe in patients with hepatic dysfunction • Less $
Danaparoid	USE WITH CAUTION due to minor risk of clinically significant HIT cross-reactivity	
LMWH	ONLY USE if other alternatives are contraindicated and HIT cross-reactivity has been excluded	

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