

Outcome of non-cardiac, non-obstetric surgery in patients with pulmonary arterial hypertension: results from an international prospective survey

Online supplementary material

Table S1: List of centres and number of patients

Centre	Number of patients
Baltimore	2
Chicago	6
Colorado	13
Clamart	31
Boston	2
Roma	7
Michigan	21
Barcelona	4
Dresden	1
Leipzig	17
Hannover	10

Table S2 Baseline variables of patients undergoing emergency and non-emergency surgery

	Emergency surgery (n=13)	Non-emergency surgery (n=101)
Hemodynamics		
mean RAP [mmHg] (n=111)	6 (3-10)	7 (3-10)
mean PAP [mmHg] (n=114)	45 (38-54)	45 (38-55)
mean PCWP [mmHg] (n=106)	9 (6.5-11.5)	9 (6-12)
Cardiac output [L/min] (n=113)	5 (4.3-6)	5 (4.2-5.9)
Cardiac index [L/min/m ²] (n=100)	2.9 (2.4-3.5)	2.9 (2.5-3.5)
PVR [dyn·s·cm ⁻⁵] (n=111)	603 (384-808)	579 (368-804)
SvO ₂ [%] (n=87)	67 (63-70)	66 (63-70)

Interval between last RHC and surgery [months]	9 (4-26)	9 (4-26)	Abbreviations: Data presented as median (interquartile range) or n (%).
NYHA class¹ and 6MWD²			
NYHA I/II	7 (54)	54 (53)	
NYHA III/IV	6 (46)	43 (43)	
6MWD < 399 m	7 (54)	39 (39)	
6MWD > 399 m	2 (15)	47 (47)	
Type of surgery			
Abdominal n [%]	9 (69)	36 (36)	NYHA,
Gynaecology/urology n [%]	1 (8)	21 (21)	New
Trauma/orthopaedic n [%]	1 (8)	20 (20)	York
Other n [%]	2 (15)	24 (22)	Heart Associat

ion; 6MWD, 6-minute walk distance; mean RAP, mean right atrial pressure; mean PAP, mean pulmonary arterial pressure; mean PCWP, mean pulmonary capillary wedge pressure; PVR, pulmonary vascular resistance; RHC, right heart catheterisation; SvO₂, mixed venous oxygen saturation; ¹missing n=4, ²missing n=9

Table S3 Detailed list of surgical interventions

Surgery	Number of cases (All patients) (n=114)	Number of cases	
		POC (n=7)	No POC (n=107)
Abdominal	46 (40)	4 (57)	42 (39)
Open cholecystectomy	3 (3)	1 (14)	2 (2)
Laparoscopic cholecystectomy	14 (12)	1 (14)	13 (12)
Bowel obstruction	5 (4)	1 (14)	4 (4)
Abdominal compartment syndrome	1 (1)	0 (0)	1 (1)
Herniotomie	10 (9)	0 (0)	10 (9)

Appendectomy	2 (2)	0 (0)	2 (2)
Hemicolectomy	5 (4)	0 (0)	5 (5)
Retrocession of artificial anus	1 (1)	0 (0)	1 (1)
Colpopexy and cystoscopy	1 (1)	0 (0)	1 (1)
ERCP	1 (1)	0 (0)	1 (1)
Liver transplantation	1 (1)	0 (0)	1 (1)
Gastric perforation	1 (1)	0 (0)	1 (1)
Explorative laparotomy	1 (1)	1 (14)	0 (0)
Trauma and orthopedic surgery	21 (18)	1 (14)	20 (19)
Knee surgery	5 (4)	0 (0)	5 (5)
Hip surgery	13 (11)	1 (14)	12 (11)
Underarm surgery	1 (1)	0 (0)	1 (1)
Foot surgery	1 (1)	0 (0)	1 (1)
n/a	1 (1)	0 (0)	1 (1)
Dental surgery	1 (1)	0 (0)	1 (1)
ENT	10 (9)	0 (0)	10 (9)
Partial pharyngectomy	2 (2)	0 (0)	2 (2)
Laryngoscopy	3 (3)	0 (0)	3 (3)
Hemiglossectomy	2 (2)	0 (0)	2 (2)
Ear surgery	1 (1)	0 (0)	1 (1)
Septoplastic surgery	1 (1)	0 (0)	1 (1)
Mastoiditis	1 (1)	0 (0)	1 (1)
General surgery	6 (5)	0 (0)	6 (6)
Thyreodectomy	3 (3)	0 (0)	3 (3)
Port implantation	1 (1)	0 (0)	1 (1)
Thoracoscopy	1 (1)	0 (0)	1 (1)
Lymph node biopsy	1 (1)	0 (0)	1 (1)
Gynaecology	18 (16)	1 (14)	17 (16)

Hysterectomy	9 (8)	0 (0)	9 (8)
Annessiectomy	1 (1)	0 (0)	1 (1)
Ovariectomy	2 (2)	0 (0)	2 (2)
Cervix-PE and abrasion	1 (1)	0 (0)	1 (1)
Breast surgery	5 (4)	1 (14)	4 (4)
Neurosurgery	3 (3)	0 (0)	3 (3)
Thoracic surgery	1 (1)	0 (0)	1 (1)
Urology	4 (4)	0 (0)	4 (4)
Orchiectomy	1 (1)	0 (0)	1 (1)
Prostatectomy	1 (1)	0 (0)	1 (1)
Ureteroscopy	2 (2)	0 (0)	2 (2)
Vascular surgery	4 (4)	1 (14)	3 (3)
Carotid endarterectomy	1 (1)	0 (0)	1 (1)
Arteriovenous fistula	1 (1)	0 (0)	1 (1)
Saphenectomy	1 (1)	1 (14)	0 (0)
Revascularisation	1 (1)	0 (0)	1 (1)

Abbreviations: Data presented as median (interquartile range) or n (%). POC, Perioperative complication; ERCP, endoscopic retrograde cholangiopancreatography; ENT, ear, nose and throat

Questionnaire used for the surgery registry

Major Surgery

Sheet I: Please fill out this form for each patient meeting the inclusion and exclusion criteria

Center:

Date of Surgery:

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Patient: Center-ID Gender:

Female Male Age:years

Diagnosis: IPAH

FPAH

PAH associated with

Connective tissue disease

disease

Congenital heart

Portal

Hypertension

HIV infection

Appetite

suppressants

Other

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NYHA-class at last assessment:

NYHA I, NYHA II, NYHA III,

NYHA IV

6 min walk test at last assessment:

. . .m

Hemodynamics at last assessment:

Date:

Right atrial

pressure mmHg

Mean PAP

mmHg

PCWP

mmHg

Cardiac output . . .

. . . . l/min

Cardiac index

. . l/min/m²

PVR

dyn.s.cm-5 or WU

SvO₂ %

Background PAH medication (please tick all the apply):

Oral anticoagulant

IV Prostanoid

Epoprostenol

Iloprost

Treprostinil

SC Prostanoid

Inhaled Prostanoid

Iloprost

Treprostinil

Endothelin

receptor antagonist

Bosentan

Sitaxentan

Ambrisentan

Phosphodiesterase-5 inhibitor

Sildenafil

Tadalafil

Calcium channel

blocker (responders only)

Other

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Was PAH medication (excluding anticoagulants) maintained in the perioperative period?

Yes

No

How was anticoagulation managed during the perioperative period?

- No anticoagulation was used at all
- Baseline therapy included a Vitamin-K antagonist, which was temporarily replaced by heparin (either IV or SC)
- Baseline therapy included a Vitamin-K antagonist, which was continued at a lower dose

- Baseline therapy included a Vitamin-K antagonist, which was temporarily interrupted without the use of another anticoagulant
- There was no baseline anticoagulation but heparin was used during the perioperative period
- Other
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Information about surgical precedence

- Emergency surgery
- Intermediate urgency
- Elective surgery

Brief description of surgical procedure:

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Estimated blood loss > 1 liter

Yes No

Septic surgery Yes

No

Systemic inflammatory response

Yes No

Vasopressors required

Yes

No

Swan Ganz catheter used

Yes

No

Anaesthesia: General anaesthesia

(please state medication used for
anaesthesia if available)

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Spinal anaesthesia

Outcome:

Death

Survived without
sequelae

Survived with
sequelae (Please
explain):
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**Was surgery performed at a center
with special expertise in the
management of PAH?**

No

Yes

Did complications occur that could have been related to PAH or medication?

No

Yes

if yes, please describe briefly:

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Did the patient require additional PAH treatment in the perioperative period?

No

Yes

if yes, please tick all that apply:

Inhaled nitric oxide (NO)

IV Prostanoid

SC Prostanoid

Inhaled Prostanoid

Endothelin

receptor antagonist

Phosphodiesterase-5 inhibitor

Catecholamines

Other

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Further comments:
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