External validations of the EHS classification for incisional hernia

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Presentation outline

- Background

- EHS Classification

- Methods

- Results

- Discussion

- Conclusion / future research

Background

- 10-30% incisional hernia after midline laparotomy[1-3]

- Great variety of hernias

- Risk factors for complications:
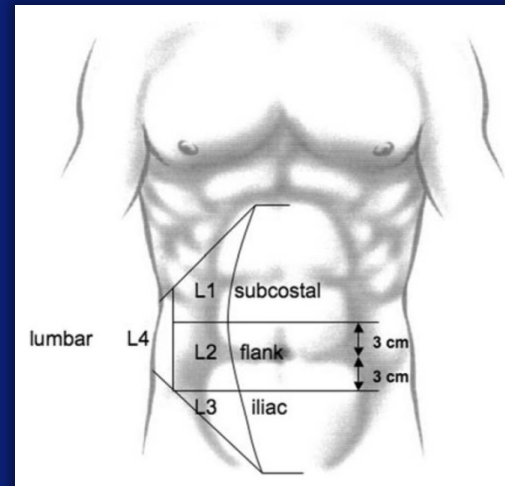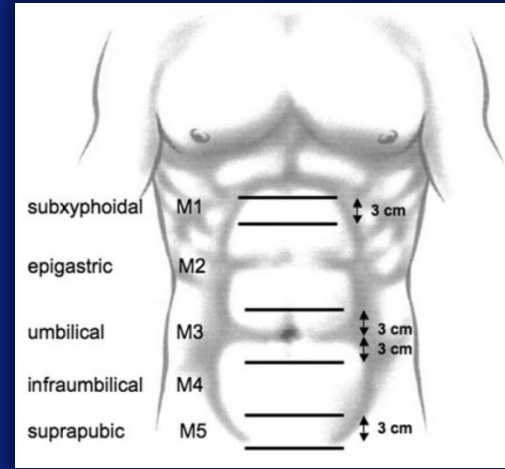 - Smoking
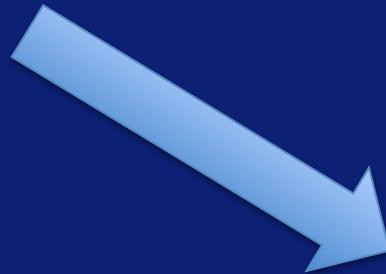 - Diabetes Mellitus
  - ↑ BMI

[1]Deerenberg *et al.* Lancet 2015
[2]Muysoms *et al.* Annals of Surgery 2016
[3]Jairam *et al.* Lancet 2017

EHS classification

Aim

Analyze the EHS classification as a predictive tool for postoperative complications

Data collection

- Hernia Club Database

- September 1st 2011 – February 29th 2016

- All incisional hernia repairs

- Data collected
  - Patient characteristics
  - Hernia characteristics
  - Surgical characteristics
  - Postoperative outcomes

Data analysis

- Primary endpoint: postoperative complications

- Univariate analyses (Mann-Whitney *U* or chi-squared tests)

- Multivariate logistic regression analysis
  - Factors from univariate analysis with p<0.20
  - Clinically relevant factors
  - Significant: p<0.05

Results – baseline characteristics

	No complication (n=1813)	Any complication (n=323)	p-value
Age in years (SD)	62.77 (14.01)	63.94 (14.09)	0.155
Male sex (%)	865 (48)	151 (47)	0.750
BMI, kg/m² (SD)	29.03 (6.85)	29.94 (7.92)	0.069
Smoking (%)	315 (16)	63 (21)	0.319
Diabetes mellitus (%)	216 (12)	46 (15)	0.239
Corticosteroid use (%)	63 (3.6)	12 (3.8)	0.828
Radiotherapy (%)	33 (1.9)	5 (1.6)	0.733
Chemotherapy (%)	107 (6.0)	22 (7.0)	0.527
AAA (%)	12 (0.7)	5 (1.6)	0.100
Connective tissue disorder (%)	6 (0.3)	1 (0.3)	0.949
Anticoagulants use or coagulopathy (%)	289 (16)	65 (21)	0.062
Presence of ascites (%)	10 (0.6)	4 (1.3)	0.249
ASA Class			0.096
I-II (%)	1249 (69)	208 (65)	
III-IV (%)	554 (31)	114 (35)	
History of abdominal wall hernia (%)			
Inguinal hernia (%)	196 (11)	28 (8.7)	0.242
Ventral hernia (%)	299 (17)	37 (12)	0.021
Incisional hernia (%)	313 (17)	68 (21)	0.105
Other abdominal wall hernia (%)	46 (2.6)	8 (2.5)	0.945
Hiatal hernia (%)	52 (2.9)	12 (3.7)	0.414
Family history of hernia (%)	15 (0.8)	2 (0.6)	0.696

2191 patients included

Current factors

Patient history

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Results - Outcomes

Characteristic	Frequency
Admission duration, days (SD)	4.3 (4.6)
Complication within 30 days (%)	323 (15)
Wound complications (%)	166 (7.6)
Surgical complications (%)	93 (4.2)
Medical complications (%)	137 (6.3)
Clavien Dindo grade	
<III (%)	176 (54)
≥III (%)	51 (16)
Unknown (%)	96 (30)
Reoperation (%)	45 (2.1)

Results – hernia characteristics

Characteristic	No complications (n=1813)	Any complication (n=323)	p-value
Hernia location			0.119
Midline (%)	1037 (80)	209 (85)	
Lateral (%)	194 (15)	27 (11)	
Combined (%)	71 (5.5)	9 (3.7)	
EHS width classification			<0.001
W1: <4cm (%)	899 (51)	94 (30)	
W2: ≥4-10cm (%)	700 (40)	146 (47)	
W3: >10cm (%)	168 (9.5)	70 (23)	
Recurrent hernia (%)	366 (21)	68 (22)	0.712
Number of recurrences			0.051
First recurrence (%)	268 (15)	52 (16)	
Second recurrence (%)	63 (3.5)	7 (2.2)	
Third recurrence (%)	31 (1.7)	5 (1.6)	
Fourth or more recurrence (%)	4 (0.2)	4 (1.3)	
Previous mesh (%)	610 (34)	113 (36)	0.597

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--- p<0.20

Results – Surgical characteristics

Characteristic	No complications (n=1813)	Any complication (n=323)	p-value
Emergency procedure (%)	69 (3.8)	18 (5.6)	0.133
Incarceration (%)	53 (3.0)	24 (7.7)	<0.001
Laparoscopic procedure (%)	519 (29)	37 (12)	<0.001
Primary closure (%)	183 (10)	40 (13)	0.137
Mesh location			<0.001
Intraperitoneal (%)	1084 (62)	136 (45)	
Sublay (%)	447 (26)	101 (34)	
Onlay (%)	37 (2.1)	20 (6.7)	
Component separation with mesh (%)	4 (0.2)	3 (1.0)	
Duration of surgery, minutes (SD)	59.87 (48.37)	94.17 (63.66)	<0.001
Altemeier wound classification[12]			<0.001
Clean (%)	1735 (96)	277 (86)	
Clean contaminated (%)	57 (3.2)	28 (8.7)	
Contaminated (%)	12 (0.7)	11 (3.4)	
Dirty (%)	4 (0.2)	7 (2.2)	
Antibiotic treatment			<0.001
None (%)	383 (21)	43 (13)	
Prophylactic (%)	1355 (75)	240 (75)	
Therapeutic (%)	66 (3.7)	37 (12)	

ALL SIGNIFICANTLY DIFFERENT

Results – multivariate analysis

	OR	95% CI	P-value
Age	1.007	0.996-1.017	0.223
Female sex	1.138	0.870-1.488	0.345
BMI	1.013	0.994-1.033	0.168
Smoking	1.334	0.952-1.870	0.094
Diabetes	0.914	0.618-1.351	0.650
AAA	2.192	0.671-7.165	0.194
Anticoagulants	1.237	0.867-1.763	0.240
History of ventral hernia	0.763	0.509-1.143	0.190
History of incisional hernia	1.009	0.654-1.554	0.969
ASA III&IV vs I&II	1.090	0.807-1.473	0.573
EHS location			
Midline			
Lateral	0.718	0.440-1.170	0.180
Combined	0.514	0.252-1.045	0.066
EHS W class			
W1: <4cm			
W2: ≥4-10cm	1.448	1.064-1.971	0.019
W3: >10cm	2.090	1.375-3.179	0.001
Number of recurrences			
First recurrence			
Second recurrence	0.831	0.530-1.303	0.420
Third recurrence	0.369	0.144-0.941	0.037
Fourth or more recurrence	0.455	0.157-1.318	0.146
Emergency procedure	0.207	0.068-0.631	0.006
Incarceration	3.187	1.199-8.467	0.020
Open vs laparoscopic procedure	2.060	1.408-3.015	<0.001
Primary closure	0.893	0.581-1.373	0.607
Duration of surgery	1.006	1.004-1.009	<0.001
Altemeier wound classification			
Clean			
Clean contaminated	2.179	1.225-3.877	0.008
Contaminated	2.855	1.074-7.585	0.035
Dirty	6.346	1.442-27.938	0.015
Antibiotic treatment			
None			
Prophylactic	1.251	0.865-1.808	0.234
Therapeutic	2.391	1.289-4.438	0.006
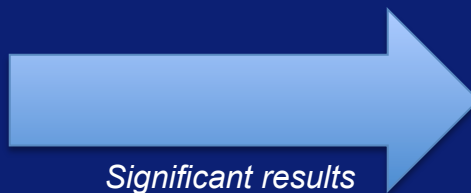
Significant results

	OR	95% CI	P-value
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Antibiotic treatment			
None			
Prophylactic	1.251	0.865-1.808	0.234
Therapeutic	2.391	1.289-4.438	0.006

Discussion

- Independent risk factors:
  - EHS width class, incarceration, open surgery, duration of surgery, Altemeier wound class, therapeutic antibiotics
- Fewer complication:
  - Third recurrence, emergency surgery

- Known risk factors from literature:[1,2]
  - Hernia size, wound class, BMI, ASA score

[1]Kokotovic *et al.* JAMA 2016
[2]Holihan *et al.* J Am Coll Surg 2015

Limitations

- No randomization

- Focus on postoperative complications → recurrence?

Conclusion

- EHS width class is an independent predictor
- EHS class should be used in studies

Future research

- Validation of EHS class primary hernias
- Compare incisional & primary
- Long term results Hernia Club

Thank you for your attention

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