

Multiparametric evaluation of risk factors associated to seroma formation in abdominal wall surgery

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SUMMARY: Multiparametric evaluation of risk factors associated to seroma formation in abdominal wall surgery.

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Introduction. Incisional hernia is one of the main topics in the general surgery since there is not a unanimous consensus concerning to the best surgical methodology to adopt. It seems that prosthetic surgery is the best technique, even if responsible for the development of peri-prosthetic seroma. The aim of this study is to assess whether the pre-operative abnormalities of the bio-humoral parameters may be considered as risk factors for seroma.

Patients and methods. From July 2016 to July 2017 at the "Policlinico Paolo Giaccone", Palermo, Department of Emergency Surgery, 56 patients included in this study, underwent laparotomic mesh repair. The inclusion criteria were: age > 18 years, incisional hernia

W2R0 according to the Chevrel classification and a monopolar technique. The main variables were: sex, age, BMI, smoke, ASA score, and co-morbidities. Among the main serum-blood variables: natraemia, kalaemia, chloraemia, calcaemia, PCR, level of glucose, creatinine, albumin and proteins in the blood. The data were analyzed using SPSS software.

Results. Univariate analysis highlighted hypo- and hyper-natraemia, hyper-kalaemia, hypo-chloraemia, high levels of PCR, hyper-glycemia, low level of serum-blood albumin and proteins, as statistically significant variables. Multivariate analysis revealed a $p < 0.05$ for PCR, hypo-albuminemia and total serum-blood-protein level.

Conclusions. Alterations of pre-operative bio-humoral parameters could be associated to a greater risk of seroma development. A better understanding of such alterations may lead to more efficient risk stratification methods. This could be essential to better address the medical resources, reducing the post-operative complications and the out-patient controls as well as the risk associated to seroma.

KEY WORDS: Incisional hernia - Risk factors - Seroma.

Introduction

Incisional hernia is still one of the mainly investigated topics of the abdominal general surgery in terms of pathophysiology, post-surgical complications, identification of the most efficient surgical approach as well as the best prosthetic material to use. The incidence is estimated to be between 11 and 20% post-laparotomy, with a significant impact on QoL and public health costs. There is no unanimity in terms of surgical approach to adopt or prosthesis to use and related implant site.

However, it seems that the prosthetic surgery, is the best choice in case of incisional hernia treatment

on a multi-parameter scale (1-9).

The process involving tissue reaction, inflammation, tissue incorporation and the resistance of the abdominal wall strongly depends on the presence of prosthetic mesh and its anatomic positioning site. The above cited elements are the main factors implicated in the recurrence disease and post-operative complications (9-12).

The aim of this study is to identify the main risk factors responsible for one of the most troubling post-operative complications in the short term period: post-operative peri-prosthetic seroma associated to intraperitoneal mesh implantation.

Patients and methods

In the period from July 2016 to July 2017, 56 patients were selected and subjected to abdomino-

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plasty for incisional hernia. A uni- and multi-variate linear regression was lead in patients with a defect \geq W2 R0, according to the Chevrel classification, and receiving an intraperitoneal mesh. The patients were subjected to surgical procedure at the Department of General and Emergency Surgery of the "Policlinico Paolo Giaccone" of Palermo. Surgery was conducted under general anesthesia. Patients received antibiotic prophylaxis when indicated, according to the hospital prophylaxis scheme. The main demographic variables identified were: sex, age, BMI, smoke, ASA score, and comorbidities. Among the main bio-umoral variables were: natraemia, kaleamia, chloremia, calcaemia, PCR, level of serum-blood glucose, creatinine, albumin and proteins.

Follow-up from 1 to 12 months.

Statistical analysis

Descriptive statistical analysis was used. The comparison between continuous variables was performed by applying statistical tests such as t-Test or Mann-Whitney U test where indicated. Categorical variables were analyzed by use of Chi-square test or Fisher's exact test where indicated. A p -value <0.05 was considered statistically significant. The tests were performed using the IBM SPSS statistics application. The aforementioned variables were firstly included in a univariate analysis and those ones considered statistically significant were included in an analytical model of multivariate logistic regression, highlighting OR with 95% confidence interval;

thus, only variables with p -value < 0.05 were included in the final model.

Results

Patients selected and included in the present study by inclusion criteria are 56. Overall, 8 peri-prosthetic post-operative seroma (14%) were observed. With regard to demographic data (gender, age, BMI, smoke, ASA score and comorbidity), no statistically significant differences were observed (Table 1). Regarding on bio-umoral abnormalities, hypo- and hyper-natraemia, hyper-kalaemia, hypo-chloraemia, high levels of PCR, blood-serum glucose, low albumin and hypoproteinemia are considered statistically significant in the univariate analysis (Table 2).

The above described data were subsequently included in the analytical model of multivariate logistic regression: also in this case it highlighted statistically significant data, particularly regarding to PCR (high level), low albumin and hypoproteinemia then representing valid data for the main final model (Table 3).

Discussion

Incisional hernia is one of the main post-laparotomy complications with an estimated incidence of roughly 11-20%. The overall impact on QoL and public health resources remains a struggle point to consider. Therefore, without any significant consen-

TABLE 1 - DEMOGRAPHIC AND CLINICAL PARAMETERS OF TOTAL POPULATION INCLUDED IN THE STUDY.

Variables	Seroma negative (48)	Seroma positive (8)	p-value
Sex M	26	6	n.s.
F	22	2	n.s.
Age	67.2	68.5	n.s.
BMI	26.5	27.2	n.s.
Comorbidities CV	7	2	n.s.
respiratory	2	2	n.s.
diabetes	10	5	n.s.
ASA I	4	1	n.s.
II	25	3	n.s.
III	19	4	n.s.
Smoke	28	7	n.s.

TABLE 2 - UNIVARIATE ANALYSIS OF PRE-SURGICAL BIO-HUMORAL PARAMETERS RELATED TO THE POPULATION OBJECT OF STUDY.

Variables	OR	p	95% CI
Hypo-Na	0.0652	0.02	0.0067-0.6386
Hyper-Na	0.0783	0.0001	0.0077-0.7532
Hyper-K	0.072	0.0109	0.0097-0.5426
Hyper-Cl		n.s.	
Hypo-Cl	0.11	0.049	0.013-0.992
Hyper-Ca		n.s.	
PCR	0.14	0.0001	0.0017-0.12
Hyper-Gl	0.085	0.004	0.016-0.454
Cr		n.s.	
Hypo-Alb	0.02	0.0002	0.0031-0.16
Hypo-Tot Pt	0.02	0.0018	0.0019-0.24

TABLE 3 - MULTIVARIATE ANALYSIS OF BIO-HUMORAL PARAMETERS OF PATIENTS INCLUDED IN THE STUDY.

Variable	p	O.R.	Low — High	
Hypo-Na+	0.8778	0.46	0.16	184.6843
Hyper-Na+	0.9981	0.45	0.21	15.23333
Hyper-K+	0.9981	0.68	0.012	125.465
Hypo-Cl-	0.2616	0.73	0.173	275.5358
PCR	0.0223	3.27	4.400	17.3111
Hyper-Gl	0.9980	0.24	0.1453	13.4141
Hypo-Alb	0.0328	4.27	2.423	145.000
Hypo-Tot Pt	0.0112	4.32	3.256	12.650

sus, the main areas to investigate remain pathophysiology, complications management, identification of the best surgical approach (laparotomy vs. laparoscopic) as well as technique, and finally, if necessary, the choice of the best prosthetic material and its anatomic implantation site. A gold-standard is still undefined even though it is the main purpose of all current studies (9-15).

Evidences showed that the process involving tissue reaction, inflammation, tissue incorporation and the resistance of the abdominal wall strongly depends on the prosthesis and its anatomic implanta-

tion site and it seems to be the main cause of post-surgical complications. Indeed, the above mentioned factors are mainly responsible for recurrence and post-surgical complications. Thus we can conclude that, in contributing to post-surgical complications, bio-humoral factors, comorbidities and demographic characteristics can be considered as main risk factors to evaluate in future studies (16-26).

The proposed study investigated on the possible role of the correlation between the above mentioned bio-humoral factors considered individually responsible for the periprosthetic post-operative seroma.

Uni- and multivariate analysis led us to consider only bio-humoral variables with p -value < 0.05 thus proving the correlation between their appearance and seroma and suggesting the most effective clinical measures to prevent its onset.

In literature, data showed as the bio-humoral parameters alterations, particularly concerning to hypo- and hyper-natraemia, hypoproteinemia and high level PCR, can negatively affects the outcome of the abdominoplasty in terms of post-operative complications. Instead, the borderline serum sodium alterations does not seem to have any influence on post-surgical complications. The physiological concentration of sodium is between 138 and 142 mmol/L; while dysnatremias arised when the concentration is > 145 mmol/L or below 135 mmol/L. The hyper-natraemia has multiple adverse effects that may explain this association, which represents the purpose of the study. The hyper-natraemia can be associated to several factors as tissue insulin peripheral resistance, an altered clearance of hepatic lactate, a decreased cardiac contractility or various neuromuscular signs such as muscle weakness and a later weaning in the mechanical ventilation. In addition, high levels of sodium seems to be able to activate helper T cells, which in turn produce interleukin-17 and have a role in the inflammation regulation, therefore amplifying the process of tissue adaptation to prosthesis by a prolonged tissue inflammation (27-31).

The main bias described in this study are represented by: the exclusion of patients in emergency surgery, the exclusion of patients treated for post-traumatic incisional hernia as well as for recidive, and the scarceness of statistical sample. Future prospective randomized studies may lead to definitive results.

Conclusions

The aforementioned bio-humoral factors seem to be involved in the peri-prosthetic post-operative seroma. Therefore, an early identification and subsequent adjustment of such alterations may considerably reduce the post-operative complications.

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