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Using machine learning to establish indications for damage control approach in patients with acute non-traumatic intra-abdominal emergencies

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Patients undergoing laparotomy for an emergency general surgery (EGS) condition constitute a high-risk group with poor outcomes. Attempts have been made to extrapolate damage control principles established for the severely injured trauma patient to the EGS population in order to improve outcomes. Using trauma indications in this patient subset has not consistently improved results and may not be appropriate. This study aims to define indications for a staged or abbreviated surgical approach specific to the EGS patient.

Methodology: In a retrospective analysis of all patients undergoing an emergency laparotomy at Greys Hospital from December 2012 to December 2018, we use decision tree discrimination to identify high-risk subgroups and thus indications for an abbreviated approach. These include patient factors, physiological factors and composite models that differ depending on the presence or absence of enteric breach at index laparotomy.

Results: Our cohort included 1461 patients with a mortality rate of 12.4 % (181). Nine hundred and ten patients (62.3%) had at least one known comorbidity on admission. There was a higher rate of comorbidities among those that died (154; 85.1%). Patient factors found to be associated with mortality were age of 46 years or more ($p<0.001$), current tuberculosis ($p<0.001$), hypertension ($p=0.014$), at least one comorbidity (0.006) and malignancy (0.033). Significant physiological risk factors found were base excess less than -6.8mmol/L($p<0.001$), serum urea greater than 7.0mmol/L ($p<0.001$) and waiting time from admission to operation ($p=0.014$). In patients with an enteric breach, those younger than 46 years and a Shock Index of more than 1.0 were high-risk. Patients without an enteric breach were high-risk if operative duration exceeded 90min ($p=0.004$) and serum urea exceeding 7mmol/dl ($p=0.016$).

Conclusion: In EGS patients, patient factors as well as physiological factors should be included as indications for an abbreviated approach at index laparotomy in order to improve outcomes.

Recent Publications:

1. Spectrum and Outcome of Emergency General Surgery Laparotomies at a Tertiary Center in South Africa Smith, Michelle T.D. et al. Journal of Surgical Research, Volume 262, 65 – 70

2. The impact of government- and institution-implemented COVID-19 control measures on tertiary- and regional level intensive care units in Pietermaritzburg, KwaZulu-Natal Province, South Africa. Southern African Journal of Critical Care 2022;38(1):33.

3. Smith, M.T.D. and Clarke, D.L. (2021), Staged laparotomy for acute non-traumatic intra-abdominal emergencies in a tertiary South African unit. ANZ Journal of Surgery, 91: 2637-2643. https://doi.org/10.1111/ans.17270.

Biography

Michelle TD Smith is a specialist general surgeon and critical care fellow at Greys Hospital, Pietermaritzburg, South Africa. She has a keen interest in clinical research and serves as a clinical lecturer at the University of KwaZulu-Natal and is a member of the university's bio research ethics board. Smith recently completed her PHD entitled "Defining modifiers and predictors of adverse outcome in patients undergoing emergency laparotomy for non-trauma".

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