The Burden of Intraoperative Hypotension in Patients Undergoing High-Risk non-cardiac Surgery and the Role of a Machine Learning-Derived Algorithm to Optimize its Management: What are We Missing Ignoring Supportive Innovations?*

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Introduction and Objectives

Intraoperative hypotension (IOH) in non-cardiac surgery entails a humanistic and economic burden associated with a higher risk of mortality and severe adverse events (SAEs). Machine learning-derived algorithms, such as the Hypotension Prediction Index (HPI), used as a supportive tool, contribute to reducing IOH depth and duration, minimizing its impact on patients' recovery. Objectives were twofold: to highlight the impact of SAEs of IOH in Spain and estimate potential savings provided by HPI use.

Methods

All surgical procedures from 2016 to 2020 by All Patients Refined Diagnosis Related Groups (APR-DRG) code (ICD10) were obtained from the Minimum Basic Data Set (Ministry of Health, Spain). High-risk surgeries were defined by a yearly mortality rate ≥5%[1]. The burden of IOH in terms of risk of acute kidney injury (AKI), and myocardial infarction after non-cardiac surgery (MINS) was estimated from multivariate logistic models in previous large-cohort studies on non-cardiac surgeries[2]. Additionally, we calculated HPI savings in terms of reduction of median postoperative length of hospital stay (LoS) based on published Spanish evidence[3]. Direct costs related to SAEs were estimated using the average costs per AKI (APR-DRG 469), and MINS (APR-DRG 190)[4]. Hospitalization cost was obtained from regional tariffs (€,2022).

Results

During that period, 127,266/year high-risk surgeries (average LoS 12.81 days; LoS-related cost: 1,181 M€/year) were conducted in Spain, of which 118,662 were non-cardiac (average LoS 12.67 days; LoS-related cost: 1,089 M€/year) (Figure 1). High-risk surgeries represented only 4.2% of interventions in Spain, but 45% of deaths were attributable to high-risk surgeries. For non-cardiac surgeries, high-risk surgeries accounted for 4.3% of intervention and 51% of mortality events. Codes included as high-risk non-cardiac interventions can be found in Table 1.

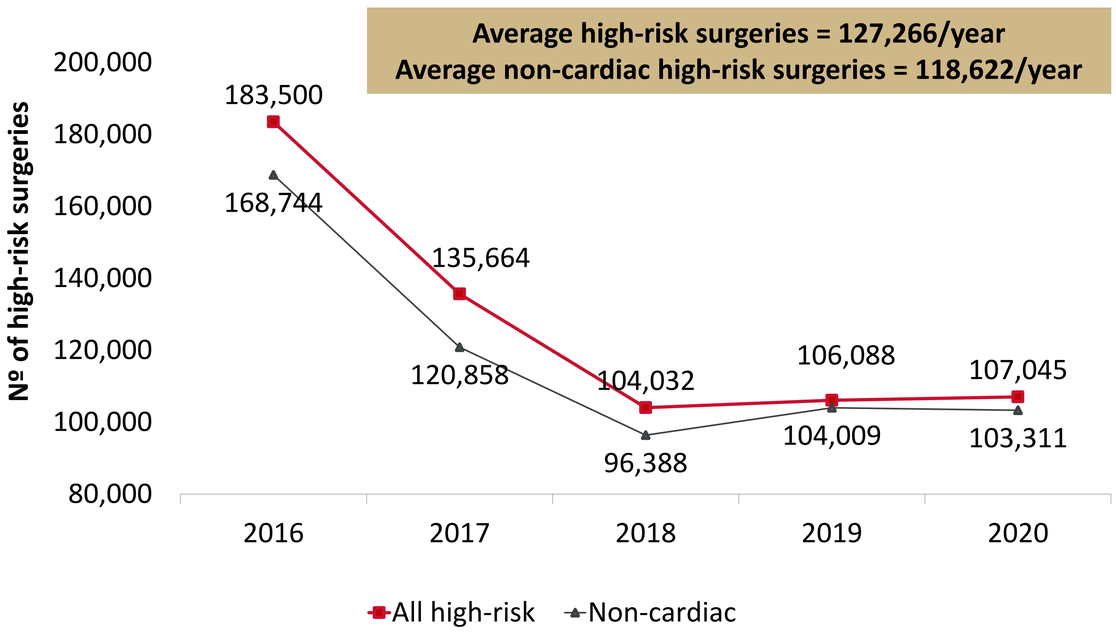

Figure 1. Evolution of high-risk surgeries, and high-risk non-cardiac surgical procedures in Spain

According to multivariate logistic models[2], 72% of high-risk non-cardiac patients would experience IOH events, causing yearly 5,296 AKIs, and 3,146 MINSs, implying an average direct cost of 34M€ (Figure 2).

Table 1. APR-DRG (V.36) codes included as non-cardiac high-risk

1, 3, 4, 5, 6, 7, 8, 9, 20, 21, 23, 24, 26, 70, 73, 89, 90, 91, 92, 93, 95, 97, 98, 120, 121, 169, 173, 180, 181, 182, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 260, 261, 262, 263, 264, 301, 302, 303, 304, 305, 308, 309, 310, 312, 313, 314, 315, 316, 317, 320, 321, 322, 361, 362, 363, 364, 401, 403, 404, 405, 440, 441, 442, 443, 444, 445, 446, 447, 480, 481, 482, 483, 484, 510, 511, 512, 513, 514, 517, 518, 519, 544, 546, 650, 651, 680, 681, 710, 711, 740, 791, 792, 793, 794, 841, 842, 850, 910, 911, 912, 950, 951, 952
APR-DRG relation of codes can be found in: https://www.sanidad.gob.es/estadEstudios/estadisticas/cmbd.htm

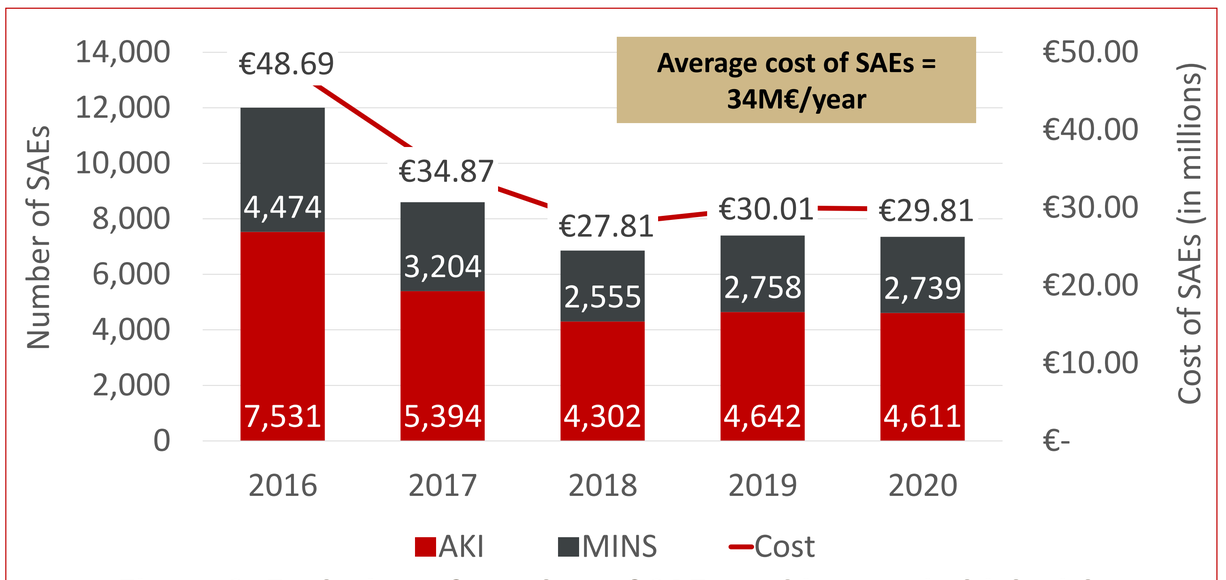

Figure 2. Evolution of number of SAEs and its cost in high-risk non-cardiac surgery: Salmasi *et al.* 2017[2]

Additionally, HPI use could minimize IOH-related post-surgery LoS, (median reduction: 2 days per surgery[3]), avoiding an average of 237,324 days yearly, with direct-related potential savings of 172M€ per year (Figure 3).

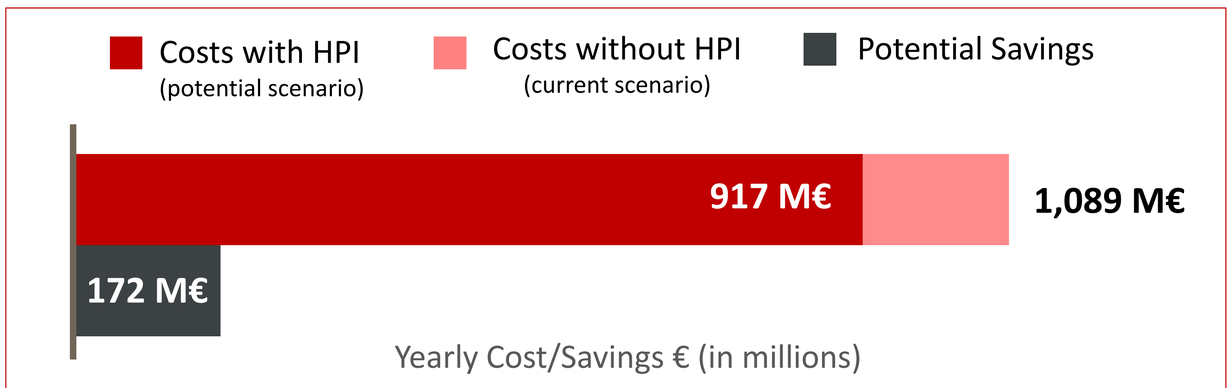

Figure 3. Yearly costs (in millions) from IOH-related post-surgery LoS and potential savings by using HPI in high-risk non-cardiac surgeries

Conclusions

- **IOH implies a significant economic burden including hospitalizations and severe adverse events.**
- **The potential reduction of IOH by using HPI may result in significant yearly savings considering only hospitalization days until discharge.**
- **Further savings may also be generated if postoperative complications associated with IOH are avoided.**

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[1]Pearse RM *et al.* Crit Care. 2006;10(3):R81. [2]Salmasi V, *et al.* Anesthesiology. 2017;126(1):47-65. [3]Solares GJ, *et al.* J Clin Monit Comput. 2022. [4]Ministerio de Sanidad. Subdirección General de Información Sanitaria. Registro de Actividad de Atención Especializada – RAE-CMBD (Accessed August 2022)

*This poster has been created considering most recent official information available, downloaded directly from the Spanish MoH platform (*https://pestadistico.inteligenciadegestion.sanidad.gob.es/publicoSNS/S/rae-cmbd*) on 30th of July to provide the interested reader with latest available evidence. All methods, results and conclusions are in full alignment with the published abstract. However, slight differences in magnitudes are shown due to these latest updates in this live database, publicly available.

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