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Original article

Prevalence and diagnosis rate of intra-abdominal hypertension in critically ill adult patients: A single-center cross-sectional study

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ABSTRACT

Purpose: To investigate the prevalence and diagnosis rate of intra-abdominal hypertension (IAH) in a mixed-population intensive care unit (ICU), and to investigate the knowledge of ICU staff regarding the guidelines published by the World Society of Abdominal Compartment Syndrome (WSACS) in 2013.

Methods: A one-day cross-sectional study based on the WSACS 2013 guidelines was conducted in the general ICU of a tertiary teaching hospital in Chongqing, China. The included patients were divided into intravesical pressure (IVP) measured group and IVP unmeasured group. The epidemiologic data were recorded, and potential IAH risk factors (RFs) were collected based on the guidelines. IVP measurements were conducted by investigators every 4 h and the result was compared to that measured by the ICU staff to evaluate the diagnosis rate. Besides, a questionnaire was used to investigate the understanding of the guidelines among ICU staff.

Results: Thirty-two patients were included, 14 in the IVP measured group and 18 in the IVP unmeasured group. The prevalence of IAH during the survey was 15.63% (5/32), 35.71% (5/14) in IVP measured group. Only one case of IAH had been diagnosed by the ICU physician and the diagnosis rate was as low as 20.00%. Logistic regression analysis showed that sequential organ failure assessment (SOFA) score was an independent RF for IAH (*OR*: 1.532, *95% CI*: 1.029–2.282, $p = 0.036$. Fourteen doctors and 5 nurses were investigated and the response rate was 67.86%. The average scores of the doctors and nurses were 27.14 ± 20.16 and 16.00 ± 8.94 respectively. None of them had studied the WSACS 2013 guidelines thoroughly.

Conclusion: Patients with a higher SOFA score has a higher incidence of IAH. The IAH prevalence in 14 ICU patients with indwelling catheter was 35.71%. Strengthening the wide and rational use of WSACS guideline is important to improve the diagnosis of IAH.

1. Introduction

Since Kron et al[1] first reported intra-abdominal hypertension (IAH) in a clinical report, researches have increasingly been conducted on IAH/abdominal compartment syndrome (ACS). It was reported that IAH could cause tissue and organ hypoperfusion and even lead to organ dysfunction.[2,3] Also, it was reported that timely decompression can effectively improve hemodynamics and reduce mortality.[4] Chang et al[5] designed a rat model of secondary IAH, which has a consistent stability and can well simulate the predisposing factors of this disease and therefore providing a solid foundation for the subsequent study of IAH interventions. A series of studies show that it is essential to emphasize the danger of IAH in critically ill patients.[6,7] Prompt recognition of RFs like abdominal surgery, trauma, body mass index (BMI), and body position[8–11]; early diagnosis with efficient detection techniques[12]; and effective treatments such as neuromuscular blockade, puncture and laparotomy decompression are essential to decrease the intra-abdominal pressure (IAP) and improve patients' organ function and prognosis.[13–15]

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It is accepted that guidelines play an important role in scientific research and clinical work.[6] The WSACS 2006 guidelines formally defined intravesical pressure (IVP) measurement as the gold standard for IAP monitoring. They standardized the relevant operation processes and defined IAH as sustained or repeated IAP ≥12 mmHg and ACS as a sustained IAP ≥20 mmHg with new organ dysfunction/failure.[16] On this basis, the WSACS 2013 guidelines defined the concept of abdominal compliance, appropriately revised and systematically classified the related RFs, and assessed the evidence level of the intervention measures.[17]

Increasingly researches in the past 20 years have focused on IAH/ACS,[18] but the relevant epidemiological data are mainly from the United States and Europe.[19,20] Surveys of the knowledge of IAH among health care workers from different countries indicate that there is still room for improvement.[21–23] This study, based on the WSACS 2013 guidelines, aims to (1) enrich the epidemiological data of IAH, and (2) assess the knowledge level of the WSACS 2013 guidelines among ICU medical workers and its relationship with diagnostic efficacy of IAH.

2. Materials and methods

2.1. Survey method

An observational cross-sectional study was conducted in the general ICU of a tertiary teaching hospital in Chongqing, China from 8:00 a.m. June 17, 2014 to 8:00 a.m. June 18, 2014. The survey was approved by the ethics committee of the hospital. And all the patients signed the informed consent.

2.2. Definitions

IAH: IVP ≥12 mmHg (1 mmHg = 1.36 cmH_2O) at least twice within 24 h;

ACS: occurrence of IVP ≥20 mmHg at least thrice within 24 h and association with new organ dysfunction/failure;

Organ failure: SOFA sub-score ≥3 points;[24]

IAH prevalence rate: the proportion of IAH/ACS confirmed by the investigators;

Diagnosis rate: proportion of IAH patients diagnosed both by investigators and ICU physicians.

2.3. Patients and grouping

Inclusion criteria included age greater than 18 years and length of ICU stay more than 24 h before the survey started. Patients or their relatives who did not agree to participate in this survey will be excluded. Patients with indwelling bladder catheter during the survey period were classified into the IVP measured group, and those without indwelling catheter were defined as IVP unmeasured group. The IVP measured group was then divided into two subgroups of IAH and non-IAH groups according to the results.

2.4. Investigated data

Demographic information (gender, age, height, weight, length of ICU stay, cause of ICU admission), physical examination and laboratory data, as well as RFs were investigated. Patients with indwelling bladder catheter and without obvious contraindications of IVP detection received IVP measurement by the investigators. The manometry device modified by Malbrain et al was used.[25] Patients were placed in a complete supine position, and 20 ml of stroke-physiological saline solution was injected into the bladder via the catheter after emptying urine. An axillary line was set as the reference plane and the IVP value was read at end-expiration by central venous pressure monitoring sets (Medifix, B. Braun Melsungen AG, Melsungen, Germany). Frequency was once every 4 h. Each measurement was repeated three min later and the average was used as the measurement value.

2.5. Questionnaire

Questionnaire was conducted in ICU staff with more than 5 years of working experience. Physician questionnaire topics included IAP threshold for IAH, primary ACS concept, IAP monitoring indications, IAH non-surgical treatment, and whether they have studied the WSACS 2013 guidelines. Nurse questionnaire topics included IAP threshold for IAH, primary ACS concept, maximum intravesical saline injection volume by IVP measurement, gold standard for IAP measurement, and whether they have studied the WSACS 2013 guidelines. The questionnaire totaled 100 points, 20 for each question. Correct answers scored 20 points, otherwise zero.

2.6. Statistical analysis

The measurement data was expressed as mean ± SD or median (interquartile range). Continuous variables with normal distribution were compared using Student t test, and abnormally-distributed variables using Mann–Whitney U test. Multiple groups were compared using One-way ANOVA and Kruskal–Wallis H test. Frequencies were compared using Pearson chi-square test and Fisher's exact test. Logistic backward regression was used to analyze the independent RFs of IAH. $p < 0.05$ was considered statistically significant. The software SPSS 13.0 (SPSS, Chicago, IL) was used for statistical analysis.

3. Results

There were 35 patients in the general ICU during the investigated period. Among them 32 met the inclusion criteria (Table 1), including 14 in the IVP measured group and 18 in the IVP unmeasured group. The remaining three patients were excluded because their length of ICU stay was less than 24 h before the start of the survey.

The IVP measured group had an averaged IVP of (10.50 ± 5.05) mmHg (4–24 mmHg). Five patients (35.71%) had IVP ≥12 mmHg, (15.20 ± 5.22) mmHg on average. Among them, one (7.14%) was diagnosed as having ACS who had an IVP of 24 mmHg and SOFA coagulation subscore of 3 points. For all the 32 patients, the prevalence of IAH was 15.63% and of ACS was 3.13%. Table 2 shows the comparison of demographic data and disease severity between IAH and non-IAH patients in the IVP measured group.

The SOFA score of IAH group was higher than that of non-IAH group and IVP unmeasured group ($p = 0.005$, $p = 0.001$). No statistical difference was observed in the other demographic data among the IAH group, non-IAH group, and IVP unmeasured group.

In the IVP measured group, only one patient with blunt abdominal trauma received diagnostic IVP measurement and the pressure was 19 mmHg, and hence the patient was diagnosed as having IAH by the ICU physician. The IVP measured by investigators was 24 mmHg. Patients in the IVP unmeasured group received no diagnostic IVP measurements by ICU staff during their entire ICU stay. Therefore, the diagnosis rate of IAH/ACS by the ICU staff was only 20.00% (1/5).

The WSACS 2013 guidelines divided the RFs of IAH/ACS into five categories with 34 subitems, including decreased abdominal wall compliance, increased gastrointestinal contents, increased abdominal contents, capillary leak/fluid resuscitation, and others/miscellaneous.[17] By referring the risk factors of the guideline, we