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Mortality predictive factors in gas forming pyogenic liver abscess: a systemic review

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ABSTRACT

BACKGROUND: Gas-forming pyogenic liver abscess constituted a rare condition encountered in 7 to 24% of all pyogenic liver abscesses [1]. Gas-forming pyogenic liver abscess was associated with a significant worsened prognosis comparatively to other pyogenic liver abscesses: mortality of 25.7-37.1% versus 6-18% respectively [2-6]. Hence, the need to establish mortality predictive factors in order to improve treatment modalities and prognosis. The aim of this systemic review was to determine the predictive factors of mortality in gas forming pyogenic liver abscesses.

METHODS: This review was carried on according to PRISMA guidelines [8]. For search strategy, four data bases were systematically searched based on key words ("gas-forming pyogenic liver abscess") AND ("predictive factors for mortality"). Were included all types of articles on predictive mortality factors on gas-forming pyogenic abscess: systemic reviews, meta-analysis, original articles, case reports, case series, letters, and editorials. Excluded articles corresponded to articles with no information about gas-forming pyogenic liver abscess, mortality, and predictive factors.

RESULTS: Our systemic review included two articles depicting four predictive factor categories: clinical, biological, radiological, and bacteriological [6,11]. These predictive factors were acute clinical presentation, elevated glucose serum level, elevated serum creatinine level, pneumoperitoneum and alveolar gas pattern on plain radiographs, total gas content, globular configuration, and shaggy margins on computed tomography, as well as Klebsiella pneumoniae as a pathogen agent [6,11].

CONCLUSIONS: The existence of predictive mortality factors for gas-forming pyogenic liver abscess implicated prompt resuscitation, antibiogram-adapted parenteral antibiotics, proactive percutaneous drainage procedures as well as draconian surveillance in order to improve the prognosis. More powerful studies are needed to well establish each factor correlation with mortality.

KEYWORDS: Gas-forming pyogenic liver abscess, mortality

I. BACKGROUND

Gas-forming pyogenic liver abscess constituted a rare condition encountered in 7 to 24% of all pyogenic liver abscesses [1]. Its pathophysiological mechanisms are still unclear. Two hypotheses were suggested [1-3]. In one hand, liver tissue damage secondary to accelerated catabolism and end products-impaired transport at inflammatory sites. In the other hand, gas accumulation due to microangiopathy-induced slow catabolic end products transport. These hypothetic mechanisms were attributed to Klebsiella pneumoniae and diabetes mellitus respectively [1-3]. Gas-forming pyogenic liver abscess was associated with a significant worsened prognosis comparatively to other pyogenic liver abscesses: mortality of 25.7-37.1% versus 6-18% respectively [2-6]. Its mortality odds ratio varied from 9.4 (95%CI: 3.0-24.5, p <0.01) to 35.7 (95% CI: 7.2-178.4, p<0.0001) [4,6,7]. Hence, the need to establish mortality predictive factors in order to improve treatment modalities and prognosis. The aim of this systemic review was to determine the predictive factors of mortality in gas forming pyogenic liver abscesses.

II. METHODS

This review was carried on according to PRISMA guidelines [8]. For search strategy, four data bases were systematically searched: Medline, Scopus, Web of Science, and Cochrane data base for studies on related topics. This research was conducted based on key words ("gas-forming pyogenic liver abscess") AND ("predictive factors for mortality") used in titles, abstracts, and/or keywords. It was made by two independent researchers on April 26th 2022.

Were included all types of articles on predictive mortality factors on gas-forming pyogenic abscess: systemic reviews, meta-analysis, original articles, case reports, case series, letters, and editorials. Excluded articles corresponded to articles with no information about gas-forming pyogenic liver abscess, mortality, and predictive factors. Concerning study selection, article retrieving flowchart is demonstrated in Figure. Two independent review authors screened all titles and abstracts meeting inclusion criteria. They retrieved all full-text articles for assessment. Disparities were discussed in order to reach consensus. Two articles were included in the review after exclusion of duplicates and non-relevant articles (Figure).Considering data extraction analysis, Quality Rating Scheme for Studies and Other Evidence and Oxford Centre for Evidence-based Medicine for ratings of individual studies allowed study quality ranking as 3 and 3C respectively [9,10].

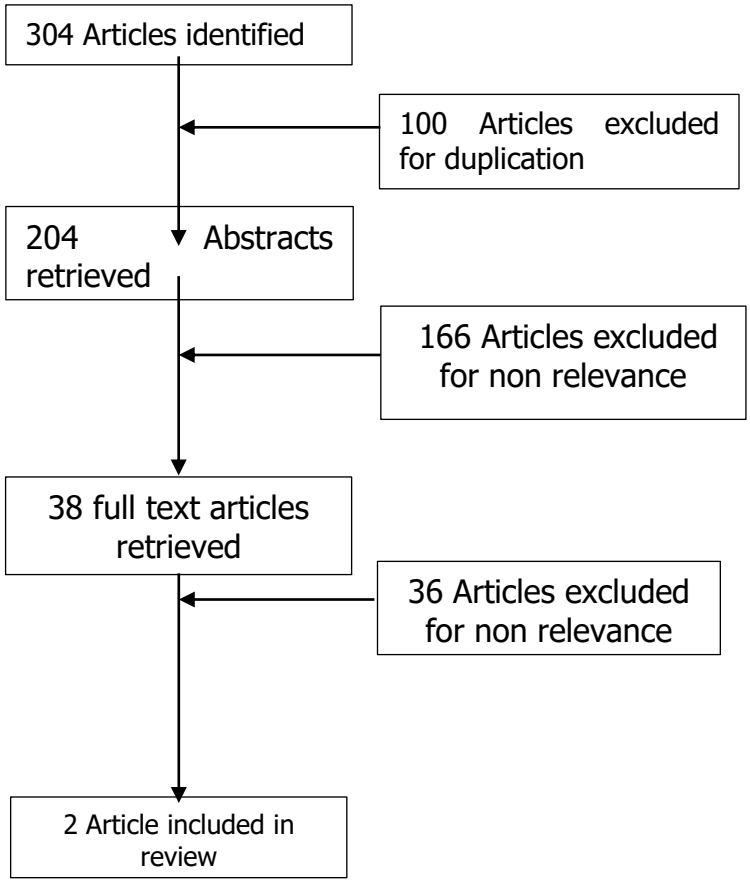

Figure. Flowchart for article retrieving process according to PRISMA guidelines [3].

III. RESULTS

Our systemic review included two articles (Table). Four predictive factor categories were concerned: clinical, biological, radiological, and bacteriological [6,11].

Table. Predictive mortality factors according to study features.

Study	Type	Ranking	Clinical factors	Biological factors	Radiological factors	Bacteriological factors
Lee et al. [11]	Retrospective cohort study 62 cases	3	Acute clinical presentation	Elevated glucose serum level	-Plain radiographs: Pneumoperitoneum, alveolar gas pattern	
Thng et al. [6]	Review 313 cases			Elevated serum creatinine level	-Computed tomography: Total gas content, globular configuration, shaggy margins	Klebsiella pneumoniae

Acute clinical presentation constituted a predictive clinical factor [6,11]. Shorter symptoms duration and diabetes mellitus were found in univariate analysis [6,12]. Age and gender didn't interfere with mortality rate [2,6,12]. For biological factors, elevated glucose serum level and elevated serum creatinine level were retained. The mean glucose serum level was 467.1±175.5 mg/dl in survivors versus 314.2±144.1 mg/dl in non-survivors with a significant difference $p<0.01$ [6,11]. The same conclusion was made for elevated serum creatinine level: 2.47±0.85 mg/dl versus 1.23±0.53 mg/dl, $p<0.001$ respectively [6,11]. Pneumoperitoneum and alveolar gas pattern were found to be predictive factors for mortality on plain radiographs [6,11]. The pneumoperitoneum was shown in 21.7% versus 0% in survivors with a significant difference $p < 0.05$ [6,11]. The alveolar gas pattern was demonstrated in 58.2% versus 15.4% in non-surviving and surviving population respectively, $p<0.01$ [6,11]. The mortality rate reached 68.4% in the presence of at least one of these two radiological factors [6,11]. The radiological predictive factors on computed tomography were alveolar structure, total gas content, globular configuration as well as shaggy margins [6,11]. Total gas content, globular configuration, and shaggy margins were noticed in 87.5% versus 16.7%; $p<0.001$, 53.3% versus 17.2%; $p<0.05$, and 50% versus 16.7%; $p<0.05$ respectively [6,11]. Multiplicity, multilocality, and diameter weren't associated to elevated mortality as radiological factors [6,11]. Concerning bacteriological aspects, the presence of Klebsiella pneumoniae in the liver pus or the blood culture was a predictive factor for mortality in univariate analysis only: 84.4 versus 65.8% and 87.0 versus 63.2% respectively with a $p<0.01$ [6,12].

IV. DISCUSSION

Our systemic review identified clinical, biological, radiological and bacteriological predictive factors for mortality in gas-forming pyogenic liver abscess. The presence of at least one factor among them implicated a prompt resuscitation, antibiogram-adapted parenteral antibiotics, proactive percutaneous drainage procedures as well as A draconian surveillance in order to improve the prognosis [6]. Acute clinical presentation implicated a virulence pathogen organism with septic shock risk causing death [6,11]. The elevated serum glucose level leaded to impaired leukocyte function and compromised host resistance [11] while the elevation in serum creatinine level corresponded to poor systemic hemodynamic status [11]. Pneumoperitoneum was due to toxic substances and infective spilling into the peritoneal cavity. The alveolar gas pattern induced sepsis by increasing blood stream and pathogen organisms' interface. It corresponded also to more difficult drainable independent loculi with early and persistent bacterial and toxic substances spread [6,11]. It was shown in only 36% of cases [1]. Alveolar structure tied in rectangular or polygonal gas spaces occupying more than half of the abscess area [11]. Total gas content was considered in the absence of significant fluid and gas-fluid levels [11]. Globular configuration was defined by a ratio of the largest to the smallest diameter less than 1.1 [11]. Shaggy margins corresponded to more than half of the margin finely spiculated [11]. These radiological findings translated surrounding tissue invading, bacterial virulence, and rapid growth [11].

Klebsiella pneumoniae as Gram-negative aerobic bacillus, as well as E. coli, produced gas as a result to liver tissue perfusion decreasing glucose fermentation [13], glucose-mixed acid fermentation within the abscess area enhanced by local acidity under 6 and poor microcirculation [12,14], as well as formic acid conversion to carbon dioxide and hydrogen gas by formic hydrogenolyses [2].The limitations of our systemic review were the small-sized, the retrospective character publications even for the review studies based on retrospective studies, and the ancient character. More powerful studies are needed in order to establish predictive factors for mortality in gas-forming pyogenic liver abscess and guide the therapeutic measures.

V. CONCLUSIONS

The existence of predictive mortality factors for gas-forming pyogenic liver abscess implicated prompt resuscitation, antibiogram-adapted parenteral antibiotics, proactive percutaneous drainage procedures as well as draconian surveillance in order to improve the prognosis. More powerful studies are needed to well establish each factor correlation with mortality.

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