

Retrospective Analysis of Histopathological and Microbiological Correlation of Autopsy Series

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Abstract

Background: In this retrospective observational study, we reviewed macroscopic postmortem examinations of surgical Intensive Care Unit (ICU) patients who died from suspected sepsis or septic shock.

Methods: All 125 Patients who were admitted in the ICU and subsequently died and cause of death labeled as sepsis/septic shock. Clinical data and postmortem findings were documented in all patients.

Results: The study included postmortem results which included gross, histopathology and microbiology. The main causes of death as reported in the patient history were sepsis with multiple organ dysfunction syndrome (70%) and cardiorespiratory failure (30%). Pathologies were detected in the lungs in 18 cases, kidneys/urinary tract 05 cases, gastrointestinal tract 02 cases, cardiovascular system 09 cases, liver 20 cases, spleen 01 case, central nervous system 30 cases, and pancreas 08 cases and in 32 cases multiple organ pathology was seen like lung, brain, liver. The autopsy and microbiological examination revealed confirmatory growth and septic focus in 40 (32%) cases only. The microbiological isolates were obtained from CSF, heart blood, ascitic fluid, pleural and pericardial fluid and tracheal aspirates. Most common isolate was *Klebsiella* in 25 cases.

Conclusion: Relevant postmortem findings explaining death in surgical ICU patients who died because of sepsis/septic shock were a continuous septic focus in approximately 40%, primary CNS pathology 37.5% cardiac pathologies in 7.2%. The most frequently affected organs were the brain, liver, lungs. Multiple organ system was also involved in 32 cases and disseminated fungal infection was the cause of death in 2 cases.

Keywords: Histopathology; Hemorrhagic infiltrations; Encephalitis; Pathology

Introduction

This retrospective observational study reviews the macroscopic, histological and microbiological findings in postmortem examinations of 125 patients who died in ICU clinically labeled as sepsis or septic shock.

Methods

125 patients during their ICU stay who subsequently died from suspected sepsis/septic shock. The clinical records of all patients were checked and the results of the microbiological specimens of each patient were retrieved to confirm infection. The postmortem examination was done in indicated cases after proper consent was performed in patients as follows: A vertical incision from suprasternal notch to the symphysis was used to expose internal organs. The organs were removed in four blocks: 1) Heart and lungs, 2) Liver and gastrointestinal tract, 3) Urogenital system, 4) Brain. Afterwards, all organs were systematically examined for macroscopic pathologies and tissue samples were taken for histological analyses and samples from CSF, pleural fluid, ascitic fluid, and peritoneal fluid; pus and heart blood were subjected to culture and microbiological examination.

The following variables of all study patients were extracted from the clinical charts as gender, age, disease status, and source of infection, the pathogen type cultured, presence of sepsis or septic shock; the number of failing organs, presence of acute respiratory distress syndrome. Autopsy reports of all study patients were searched for pathologies of the following organ systems: cardiovascular system, lungs, liver, kidneys and urinary tract, gastrointestinal tract, spleen, pancreas, and central nervous system. Pathologies of other organ systems were recorded separately.

Postmortem findings of each organ system were entered. The weight of each organ was measured. Heart was seen whether enlarged or not and further seen for any diffuse or localized red-blue (yellow-tan at later stages) lesions of the myocardium with or without occlusion of the supplying coronary artery, dilatation of the right or left ventricular chamber, reddened and granular pericardium optionally

accompanied by pericardial effusion, fluid collection in the pericardial cavity and any friable, bulky or destructive vegetation's on cardiac valves containing fibrin, inflammatory cells, and pathogens on histology were studied. Lungs for any frothy, blood-tinged fluid. Consolidated lung areas (increased in volume) with patchy infiltrations rendering pus on sectioning, Fluid collection in one or both pleural cavities (blood, hemothorax; pus, pleural empyema). Reddened, edematous mucosa of substantial parts of the tracheobronchial tree; optionally accompanied by serous or mucous secretion. Partial or total occlusion of a pulmonary artery is due to a venous thrombus. Consolidated lung areas; with hemorrhagic infiltrations. Reddened, edematous pleura optionally accompanied by a fibrinous exudate, raised, red-blue (red-brown at later stages), wedge-shaped areas extending to the lung periphery optionally accompanied by fibrinous pleuritis. Consolidated (dark blue-red) lung areas reduced in volume.

Liver was examined whether yellow, greasy and readily fractured with increased weight (2000 g). Diffuse, patchy and pale alterations localized in the central region of the liver lobules, purulent inflammation of the extra/intrahepatic bile ducts with or without necrotic infiltration of portal fields. Enlarged or tense gallbladder with bright-red to green-black patchy discoloration and optionally fibrin-layered serosa or suppurative exudate.

Diffuse or localized bowel alterations with dilatation, edema and wall thickening (optionally intraluminal gas) with or without occlusion of the supplying mesenteric artery. Edematous gastric mucosa; with vascular congestion, but maintained mucosal barrier Intraluminal blood originating from lesions of the gastrointestinal tract. Erosions of the gastric or duodenal mucosa are equal to or greater than 0.5 cm in diameter. Continuous localized or diffuse inflammation of the peritoneum with suppurative or fibrinous exudate. Diffuse or localized bowel alterations with congestive edema, wall thickening, dusky to purple-red discoloration and hemorrhagic lesions with or without luminal blood.

Serous fluid collection in the abdominal cavity. Pale and wedge-shaped areas of the spleen; optionally accompanied by fibrin coverage of the splenic capsule. Enlarged and soft spleen with deliquescent splenic parenchyma on incision. Diffuse or

localized, pale or reddish areas of the pancreatic parenchyma. Blue-black hemorrhagic areas interspersed with foci of yellow-white, chalky fat necrosis.

Kidney for any diffuse enlargement with or without specific parenchymal pathology. Sharply demarcated, pale (yellow-white at later stages) areas containing hemorrhagic foci with or without occlusion of the supplying renal artery. Grayish-white discoloration of pyelum and ureter optionally accompanied by patchy inflammation or necrosis of the renal parenchyma. Reddened, edematous mucosa of the urinary bladder optionally accompanied by a suppurative exudate.

Postmortem findings of the central nervous system studied like brain edema, ischemia, intracerebral hemorrhage, encephalitis. Swollen brain with flattened gyri, narrowed sulci and compressed ventricular cavities, any tentorial or foraminal brain herniation. Diffuse or localized, pale and swollen (gelatinous or liquefied at later stages) areas of the brain without occlusion of the supplying cerebral artery.

Statistical Analysis

The SPSS software program (SPSS 12.0.1.; SPSS, Chicago, IL) was used for statistical analysis. Descriptive statistical methods were applied to evaluate the frequency of pathologies of single organ systems. In order to compare the frequency of organ pathologies between groups, Fisher's exact test was used, as appropriate. P values 0.05 were considered as indicating statistical significance. Data are given as mean values SD, if not otherwise indicated.

Results

Post mortem examination was done in the 125 patients of which all were male except one female patient who died of metastatic breast cancer. The age range was in between 26-47 yrs. of age. Primary CNS pathology: 37.5% cardiac pathologies in 7.2%. The most frequently affected organs were the brain, liver, lungs. Multiple organ system was also involved in 32 cases and disseminated fungal infection was the cause of death in 2 cases, malignancy was the cause of death in 08 cases (**Figure 1**).

Table 1: Postmortem organ changes in the autopsy findings (n=125).

Brain PM changes				Lung		Liver	Kidney	GI tract	Heart			Neoplasms	
Haemorrhage	Infarct	abscess	edema	Congestion and pneumonia	abscess	Cirrhosis	Acute tubular necrosis	Ischemia	Pancreatitis	CAD	Cardiomyopathy	Lymphoma	Carcinoma
14	10	3	62	19	2	20	2	2	8	7	2	5	3

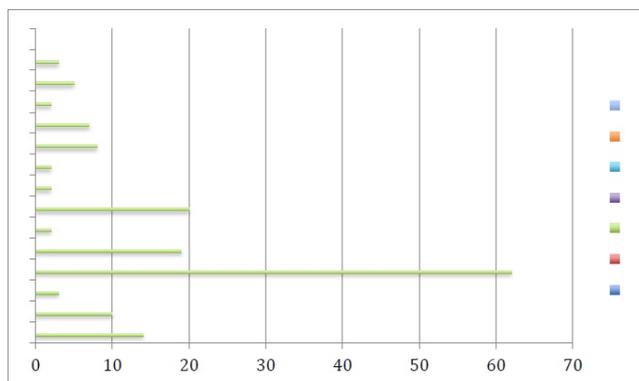


Figure 1: showing the corresponding PM findings in the organs as tabulated in **Table 1**.

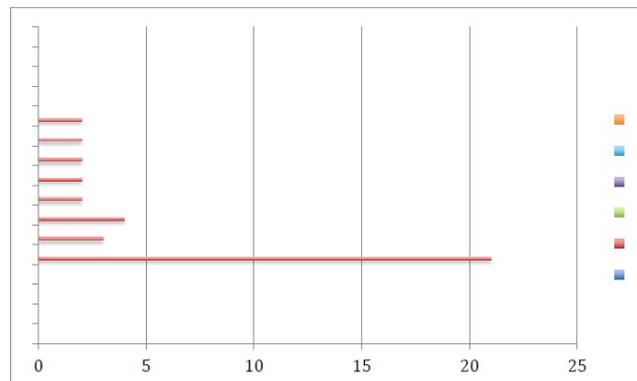


Figure 2: Graph showing the isolates as depicted in the **Table 2**.

The brain edema was observed in nearly 62 patients 49.6% of patients. Fifty of these patients were admitted to the ICU because of a primary CNS pathology. The results of the postmortem summarized in form of **Table 1**. Brain hemorrhage was seen in 14 patients, infarct in 10 cases, abscess in 03 cases, edema 62 cases, lung congestion and pneumonia 19 cases, lung abscess in 02 cases, liver cirrhosis in 20 cases, acute tubular necrosis histologically, pancreatitis in 08 cases, coronary artery disease in 07 cases, cardiomyopathies 02 cases, malignancies in 08 cases. Septic focus found in approximately 40% of the postmortem samples. The culture grew *Klebsiella* in 23 cases, *Acinetobacter* in 03 cases, *Escherichia coli* in 04 cases, streptococci in 02 cases, 02 cases in *Pseudomonas*, *Burkholderia* in 02 cases, *Enterococci* in 02 cases and *candida* in 02 (**Table 2**). The most common isolate is *Klebsiella* (52%) (**Figures 2-4**).

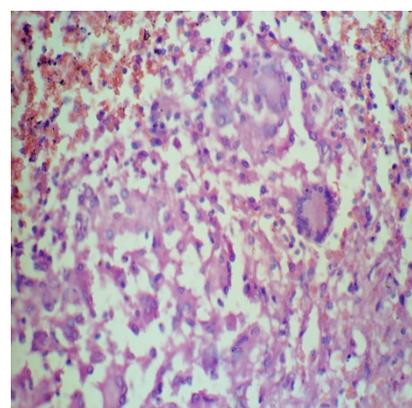


Figure 3: Showing spleen with fungal granulomas and giant cell.

Table 2: Showing the microbiological isolate from the autopsy cases.

Isolate	Number of cases
<i>Klebsiella</i>	21
<i>Acinetobacter</i>	3
<i>Escherichia coli</i>	4
<i>Streptococci</i>	2
<i>Enterobacter</i>	2
<i>Burkholderia</i>	2
<i>Candida</i>	2
<i>Pseudomonas</i>	2

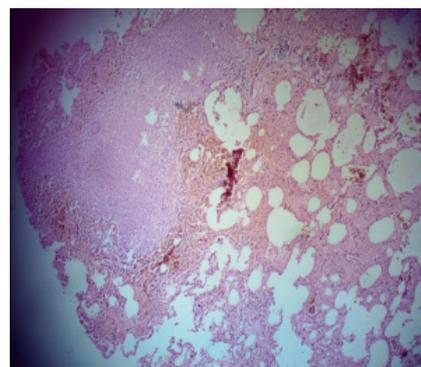


Figure 4: Microphotograph of lung showing congestion and haemorrhage.

Discussion

To evaluate sepsis the main features are the gross pathology, the microscopic pathology (histopathology and cytopathology), and identification and quantification of infectious agents [1-5]. Sepsis-related myocardial dysfunction includes reduced left and right ejection fractions and elevated heart rate and evidence of apoptotic damage to cardiac myofibrils and myocarditis with enlargement of capillary endothelial cells as part of the generalised endothelial, upregulation phenomenon. Given the generally old age of patients admitted to ICU with sepsis, many will have coronary artery disease, with or without previous myocardial infarction, at autopsy [6-23].

In our patient population, most continuous septic foci detected were located in the lungs, CSF, peritoneal cavity and heart in only 40% of the cases. Of all organ pathologies, the most relevant for patient mortality seems to have been pathology of the cerebral nervous system and brain and cardiovascular pathology, since uncontrollable shock was the clinical cause of death in 25% of the study population and almost all patients had shock [21-26]. Patients who died of septic shock showed more such apoptosis in the amygdala and medullary autonomic nuclei than those dying of non-septic shock and sudden extra-cranial trauma which was seen in our patients dying due to nonsepsis causes and in whom there were no microbiologic growth.

Conclusion

The main clinical and postmortem causes of death in critically ill patients in ICU who were labeled as sepsis were brain pathology, refractory multiple organ dysfunction syndrome and uncontrollable cardiovascular failure. Relevant postmortem findings explaining these results were a septic focus in only 40% of cases. The most frequently affected organs were the brain, liver, cardiopulmonary system. Autopsy examination of the organs and histology helps to arrive at the final cause of death.

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