

# Factors Indicating a Bad Prognosis in Patients of Emphysematous Pyelonephritis with Diabetes

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## ABSTRACT

**Aim:** To evaluate our experience with emphysematous pyelonephritis in a tertiary care facility and to describe our approach.

**Study design:** Cross-sectional retrospective study

**Place and duration of study:** Dept of Urology, Shaikh Zayed Hospital, Lahore from 1<sup>st</sup> January 2017 to 31<sup>st</sup> December 2020.

**Methodology:** Thirty six patients who died of emphysematous pyelonephritis out of the 976 patients and between 34-82 years were enrolled. Used classification systems include Wan and Huang. We examined potential predictive indicators for mortality as well as the clinical and treatment characteristics of these patients.

**Results:** There were 2.27 female for every male. Poor prognosis is correlated with advanced grade. The biggest number of unfavourable prognostic variables is accounted for by deranged HbA1C 27.8% and advanced grades 33.3%. However, DIC causing thrombocytopenia 13.9% and hypotensive shock 13.9% are significant causes of mortality in emphysematous pyelonephritis. The low protein content 11.1% has the lowest mortality risk. The most frequent clinical signs were tachycardia in 14, fever in 9, pyuria in 8 and flank pain in 5 patients.

**Conclusion:** Advanced Huang and Tseng Classification grade is the principal reason for death in our study, followed by shock, hypoproteinemia, DIC-induced thrombocytopenia, and elevated HbA1C levels.

**Keywords:** Emphysematous pyelonephritis, Diabetes, Prognostic factor

## INTRODUCTION

Depending on the severity, Emphysematous Pyelonephritis is a rare necrotizing infection of the renal parenchyma that can spread from the collecting tubules up to the development of subcutaneous gas<sup>1</sup>. Emphysematous pyelonephritis was initially described by MacCullum in 1898<sup>2</sup>. Emphysematous Pyelonephritis is one of the infections that diabetic persons are most susceptible<sup>3</sup>. Diabetes, which over time reduced immune system activity, made the renal parenchyma more vulnerable to necrosis from infections like E. coli and Klebsiella.<sup>4</sup> Prior to the invention of antibiotics, the mortality rate of emphysematous pyelonephritis was around 80%. With the introduction of new generation antibiotics, the mortality rate of emphysematous pyelonephritis has already dramatically lowered and is now only 25%<sup>5</sup>.

There is considerable debate regarding the EPN's pathophysiology. However, it is believed that, particularly in diabetics with associated microvascular disease, high glucose tissue concentration, poor tissue perfusion, impaired immunity, and a hypoxic environment in the renal medulla predispose more of these patients to tissue ischemia and necrosis, which promotes the growth of the gas-forming organisms.<sup>6</sup> Emphysematous pyelonephritis has a mortality rate of up to 50%, with advanced EP grades on a CT scan being the primary cause of death. Treatment for emphysematous pyelonephritis should start as soon as possible. Some medical professionals support urgent nephrectomy for emphysematous kidney. Others, however, favour conservative medical treatment<sup>7,8</sup>. The diagnosis of EP has been made using a variety of radiological modalities, including as ultrasound and X-ray abdomen, however these investigations are not very reliable when it comes to EP. The gold standard test for emphysematous pyelonephritis diagnosis and staging is a CT scan. We employed the Huang and Tseng classification in our investigation despite other classifications for emphysematous pyelonephritis having been provided. Lu et al<sup>7</sup> displayed four pyelonephritis with emphysema; type 1: gas with in collecting system, type 2: gas with in parenchyma, type 3: gas in paranephric and perinephric space and type 4: bilateral EPN or presence of gas in solitary kidney. Huang and Tseng has claimed increasing mortality trend from grade 1 to Grade 4<sup>4</sup>.

With medical care and an immediate nephrectomy, mortality can be reduced by up to 25%, and with medical care and pus drainage, it can be reduced by up to 13.5%. High blood sugar levels encourage the growth of microorganisms that digest glucose and necrotize the kidneys, which releases gases including H<sub>2</sub> and CO<sub>2</sub><sup>10</sup>.

## MATERIALS AND METHODS

After IRB permission, this retrospective cross-sectional observational study was conducted at Sh. Zayed Hospital, Lahore from 2017 to 2020 and 36 patients with an emphysematous pyelonephritis diagnosis were enrolled. All non-survivor diabetic patients having diagnosis of emphysematous pyelonephritis are included. Those patients who have ambiguity in their data or suspicion of diagnosis were excluded. Their files were examined and information on their clinical characteristics, hemodynamic status, laboratory findings, radiographic data, therapy strategy, and outcomes was gathered. Clinical characteristics were noted, including signs and symptoms, their duration, and co-morbidities. CT scans without contrast were incorporated in radiological research. Platelet count and serum albumin levels were found in the laboratory. At the presentation, the results of the CT scan (without contrast) are examined to classify the patients according to the Huang and Tseng Classification.<sup>4</sup> Shock (BP <90/60mmHg), abnormal HbA1C (>7.5%), thrombocytopenia (1 10000/ml), and hypoproteinemia (3g/dl) were the criteria we used. All collected information was entered and analyzed through SPSS-20.

## RESULTS

The female to male ratio was 2.27:1. Advanced grade is associated with poor prognosis. Deranged HbA1C (30.5%) and advanced grades (33.3%) are accounts for highest percentage for poor prognostic factors. However, hypotensive shock (11.2%) and DIC (11.2%) leading to thrombocytopenia are considerable factors of mortality in emphysematous pyelonephritis. Low protein amount (13.8%) has least to cause mortality. There were tachycardia 14%, fever 9%, pyuria 8% and flank pain were the most prevalent clinical symptoms 5% (Table 1, Fig. 1)

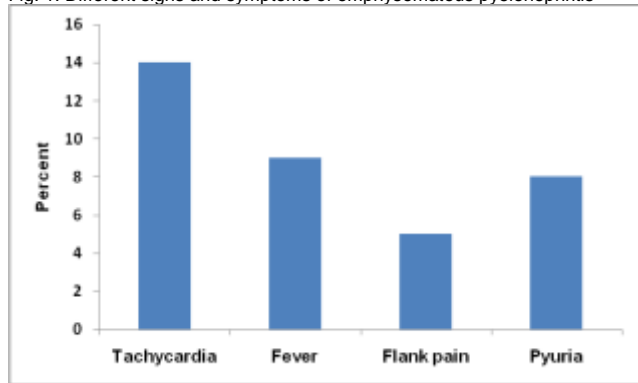
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Table 1: Prognostic factors affecting mortality in emphysematous pyelonephritis (n=36)

Variable	No.	%
Deranged HbA1C	11	30.5
Shock	5	13.8
Hypoproteinemia	4	11.2
Grade 2 and 3 of EP	12	33.3
DIC leading to thrombocytopenia	4	11.2

Fig. 1: Different signs and symptoms of emphysematous pyelonephritis



**DISCUSSION**

A necrotizing infection of the renal parenchyma accompanied by an accumulation of gas in the necrotized tissue is referred to as emphysematous pyelonephritis. Because it accurately depicts the renal and pararenal structure, the CT scan is considered to be a valid diagnostic tool in the diagnosis of emphysematous pyelonephritis.<sup>3</sup> Participants' average ages ranged from 34 to 82. Many different symptoms, including cost vertebral discomfort, fever, flank pain, vomiting, and dysuria, were reported by EP patients. The renal system is thought to be more susceptible to necrotize due to a number of variables, including uncontrolled diabetes, shock, hypoproteinemia (albumin), disease severity, and thrombocytopenia. According to our analysis, the most significant indicator of a bad prognosis is an advanced EP grade. The mortality rate in our study is 33.3% for grades 3 and 4. Combination therapy can be used to treat *E. coli*, *K. pneumoniae*, and *P. mirabilis*. One example is the use of amikacin with third-generation cephalosporin. Drug resistance has become more common due to the rising global use of antibiotics. Third-generation cephalosporins are less effective against bacteria that develop extended-spectrum beta-lactamase (ESBL). Antibiotics alone are insufficient to treat EPN, and early findings show that patients who received insufficient drainage through the insertion of a ureteral stent or a percutaneous nephrostomy tube (PCN) (9%) still had a significant mortality risk (19%) [8] Emphysematous pyelonephritis survivors received medicinal therapy, a minimally invasive surgery, and DJ stent implantation. Our research supports the conclusions of Olvera-Posada et al.<sup>11</sup> Emphysematous pyelonephritis has a bad prognosis when there is septic shock. Septic shock from a complicated UTI leads to hypotension which ultimately causes the renal parenchyma to be significantly less perfused for antibiotics and permits the UTI organisms to penetrate the renal parenchyma. According to our investigation, 13.9% of cases of emphysematous pyelonephritis were caused by shock.<sup>12-15</sup> With septic shock, the affected area is comparatively less receptive to antibiotic invasion and relatively more vulnerable to infections causing renal tissue to ferment. Mortality rates for severe sepsis range from 30 to 40 percent. When the host immune defence system detects the pathogen-associated molecular patterns, it causes the production of inflammatory cytokines, which favours adaptive immunity. Following a switch from the innate to the adaptive immune system, immunosuppression results from a TH2 anti-inflammatory response.<sup>16</sup> Sepsis is most likely the

aetiology of DIC. Hyperactivation of the coagulation cascade, which causes the ischemia factor to predominate, is what defines it. In our analysis, DIC was found in 13.9% of cases, making it the most frequent prognostic feature.<sup>12,14,15</sup> DIC results in micro vascular thrombosis, which causes the renal papillae to shed off and eventually create obstructive uropathy along with an intensification of renal system necrosis. 27.8% of EP patients have uncontrolled diabetes mellitus, which is a negative prognostic indicator. In diabetic patients, emphysematous pyelonephritis becomes more complicated, resulting in bacteremia, bilateral disease spread, and renal failure. Additionally, diabetes increases the severity of UTIs; the average hospitalisation rate for patients with acute pyelonephritis was reported to be 3.4–24, which was one time greater in diabetics than nondiabetics.<sup>10</sup> Leukocyte function is hampered by an altered blood glucose level, which changes the humoral response to infection. High blood sugar levels provide an ideal environment for uropathogens to grow and ferment renal tissue, which produces CO<sub>2</sub> and H<sub>2</sub> that can be felt as crepitus. A reasonable method to managing EP with diabetes is to treat uncontrolled diabetes mellitus adjuvant with antibiotics. In diabetic renal tissue, prolonged hyperglycemia activates NF-B, which causes vascular dysfunction. Numerous genes that encourage inflammation and cell adhesions are triggered when NF-B is activated. Diabetic nephropathy is caused by permanent morphological and physiological alterations in renal tissue brought on by the activation of profibrotic (FN, ICAM-1, VCAM-1) and pro-inflammatory (NF-B, IL-1B, IL-6, TNF-) genes<sup>17</sup>.

11.1% of patients who died from EP had hypoproteinemia. Fulminating infections are brought on by a decline in immunity that is linked to hypoproteinemia. In patients with hypoproteinemia, conventional therapy frequently fails. The main cause of death in patients in the intensive stage is hypoproteinemia.<sup>18</sup> There has not yet been established a proper management protocol. Renal salvage surgery dramatically reduced the mortality rate in emphysematous pyelonephritis by up to 21%<sup>13</sup>.

**CONCLUSION**

The leading cause of death was advanced Huang and Tseng Classification grade, which is followed by DIC-induced thrombocytopenia, shock, hypoproteinemia, and abnormal HbA1C. To reduce the likelihood of shock, prompt intensive care should be given. Hypoproteemia and diabetes could be treated quickly to reduce mortality risks. Nephrectomy should only be used as a last resort if medical therapy fails.

**Conflict of interest:** Nil

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