

A Cross-Sectional Study on Epidemiology, Clinical Profile of Acute Pyelonephritis among Adults in a Tertiary Care Hospital

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Abstract: ***Introduction:** Acute pyelonephritis (APN) is a significant urinary tract infection posing substantial morbidity and mortality risks. While global statistics on APN abound, regional data remain scarce. **Methods:** A comprehensive cross-sectional analysis was undertaken at Chengalpattu Medical College, spanning 18 months, with a cohort of 107 participants exhibiting signs of APN. Our methodology meticulously covered various parameters, including clinical presentations, prevalent comorbidities, the entirety of blood and urine investigations, diverse radiological assessments, and a range of medical interventions. Additionally, the final health outcomes of the participants were recorded. **Results:** 67.29% of the cohort were females with an average age of 42.76 years. Flank pain was reported by 66.3%, and Diabetes Mellitus was a notable comorbidity in 63.5%. Escherichia coli was the primary causative agent in 60.74% of cases. Treatment varied: 42.05% received conservative care, 46.7% had Double J stent placements, and 11.21% underwent percutaneous nephrostomy. A 2.8% mortality rate was observed. **Conclusions:** This study highlights APN's complexities, emphasizing gender disparities, the role of Escherichia coli, and diverse treatment outcomes. It provides crucial regional insights, promoting a nuanced and patient-specific approach to care.*

Keywords: Acute Pyelonephritis, Clinical presentation, CT Scan, Urinary Tract Infection

1. Introduction

Acute pyelonephritis (APN) is a severe urinary tract infection (UTI) that presents significant morbidity and potential mortality. In the US, APN affects up to 250,000 individuals annually, with women being more susceptible than men [1]. With Escherichia coli being the causative agent in approximately 80% of these cases, the seriousness of APN is further underscored by reported mortality rates of 10% to 20% [2], [3]. Several studies have highlighted the importance of predicting outcomes in APN patients, emphasizing various risk factors, including urinary abnormalities, general health, and specific characteristics of the infecting microorganisms [4], [5]. Despite the guidelines offered by the American Society of Infectious Diseases, controversies still surround the diagnostic approaches and criteria. Notably, while DMSA renal scintigraphy has traditionally been regarded as a trusted diagnostic tool, recent studies suggest that CT scans might provide more accurate results [5] – [8]. Other significant risk factors

include frequent sexual activity, genetic predispositions, advanced age, and previous urinary tract disturbances [1] – [3], [9], [10]. As APN's global data becomes increasingly available, there emerges a pressing need to delve into local and regional statistics to fully grasp the condition's nuances. Addressing this need, our study focuses on Chengalpattu Medical College's patient demographics, aiming to determine the epidemiology, risk factors, phenotype, and treatment outcomes of adult patients with pyelonephritis admitted over an extensive 18-month period.

2. Methods

Study Design and Setting:

This study was a cross-sectional analysis conducted over a duration of 18 months involving 107 participants at Chengalpattu Medical College.

Study Participants:

Our study at Chengalpattu Medical College specifically targeted patients presenting with clinical or radiological features suggestive of Acute pyelonephritis. From this pool, we took care to exclude certain individuals to maintain the clarity and specificity of our study results. Those excluded were individuals below 18 years of age, ensuring our focus remained on adult patients. Pregnant women were also left out due to the unique physiological changes they experience which could potentially influence study outcomes. Furthermore, patients who had recently undergone any form of urological surgery or had a history of renal transplantation were also excluded to avoid any surgical implications or post-operative conditions affecting the results. After this meticulous screening, we successfully incorporated a total of 107 patients who precisely fit our criteria, providing us with a representative sample for our analysis on acute pyelonephritis.

Data Collection:

Data was collated using a predetermined proforma that encompassed:

- Presenting complaints and findings from clinical examinations.
- Associated comorbidities, notably Diabetes Mellitus (DM) and urolithiasis.
- Blood investigations such as Complete Blood Count (CBC), serial Random Blood Sugar (RBS), Fasting Blood Sugar (FBS) & Post Prandial Blood Sugar (PPBS), Renal Function Tests (RFT), Serum Electrolytes, and Liver Function Tests (LFT).
- Urinalysis including examination for albumin, sugar, deposits, and acetone.
- A culture and sensitivity test (C/S) of the urine was also conducted.
- Radiological assessments utilizing Ultrasonography (USG) of the abdomen & Kidneys, Ureters, and Bladder (KUB) and, when required, a CT scan of the abdomen.
- Details of any interventions undertaken
- The eventual outcomes were also recorded.

Data Analysis:

The data collected during the study was systematically entered into a Microsoft Excel spreadsheet. For the subsequent analytical process, we employed IBM SPSS Statistics for Windows, Version 20.0. Within our analysis, categorical data were articulated as percentages or proportions, while continuous data were delineated using its mean, complemented by the Standard Deviation (SD). Our approach ensured the use of both descriptive and inferential statistics, providing a comprehensive perspective on the data collated.

3. Results

Table 1: Patient Characteristics and Data from our study

S. No	Characteristics From Study	Data [N (%)]
1	Female	72 (67.29%)
2	Male	35 (32.71%)
3	Mean age (years)	42.76 ± 18.52
4	Duration of symptoms before hospitalization (days)	4.59 ± 8.17

5	Mean bodytemperature (F)	100.79 ± 2.19
6	Duration of fever (days)	4.94 ± 7.81
7	Leucocytosis (N of patients)	104 (97.1%)
8	Mean leucocytes (/mm3)	18 670 ± 5342
9	Pyuria	93 (86.91%)
10	Risk factors (N of patients)	82 (76.63%)
11	Presence of renal failure	35 (32.17%)
12	Days of hospitalization	12 ± 12
13	Most Common Presentation: Flank Pain	71 (66.3 %)
14	Most Common Associated Comorbidity: Diabetes Mellitus	68 (63.5%)
15	Most Common Organism: Escherchia Coli	65 (60.74%)
16	Emphysematous Pyelonephritis	26 (24.29%)
17	RFT Altered	35 (32.17%)
18	Urine C/S positive	68 (63.55%)
19	Blood C/S positive	15 (14.01%)
20	Both Urine C/S and Blood C/S positive	4 (3.73%)

Table 2: Different Management Strategies in our Study

S. No	Management Strategy	Data
1	Conservative Management	42.05% (n = 45)
2	Double J Stent	46.7% (n = 50)
3	Percutaneous Nephrostomy	11.21% (n = 12)

In this study involving a total of 107 patients, a predominant proportion were females, accounting for 67.29% (n=72) of the cohort, while males represented 32.71% (n=35). The average age of the participants was 42.76 years with a standard deviation of 18.52 years. (Table 1)

Most patients experienced symptoms for an average duration of 6.59 days (±10.17) prior to being hospitalized. Upon admission, the average ear temperature was found to be 100.79°F with a standard deviation of ±2.19. These patients had an average fever duration of 4.94 days (±7.81). A substantial majority, 97.1% (n=104), exhibited leucocytosis with an average leucocyte count of 18,670/mm³ (±5342). Pyuria was observed in 86.91% (n=93) of the participants.

In terms of risk factors, a significant 76.63% (n=82) of the patients displayed at least one, and renal failure was evident in 32.17% (n=35) of the cohort. The average hospital stay for these patients was approximately 12 days with a variability of ±12 days.

The most frequently observed clinical presentation among patients was flank pain, with 66.3% (n=71) reporting this symptom. Diabetes Mellitus stood out as the most common comorbidity, being present in 63.5% (n=68) of the patients. In terms of infectious agents, Escherichia coli was the predominant organism identified in 60.74% (n=65) of the cohort. Emphysematous pyelonephritis was present in 24.29% (n=26) of the individuals, while altered renal function tests (RFT) were noted in 32.17% (n=35) of the cases.

Regarding microbiological assessments, 63.55% (n=68) had a positive urine culture, whereas blood cultures turned out positive in 14.01% (n=15). Concurrent positivity in both urine and blood cultures was a rarity, observed in only 3.73% (n=4) of the patients.

From a management perspective, 42.05% (n=45) of the patients were managed conservatively. Urological interventions, such as the placement of a Double J stent, were required for 46.7% (n=50), and percutaneous nephrostomy (PCN) was employed in 11.21% (n=12) of cases. (Table 2) Mortality in this cohort was observed to be 2.8% (n=3).

4. Discussion

Our interest in Acute Pyelonephritis (APN) deepened due to the noticeable increase in its prevalence and the lack of clear guidance about the use of CT scans for diagnosis. A point of note was the absence of positive urine tests in a fraction of our patients, suggesting the potential limitations of traditional diagnostic tools and advocating for broader diagnostic methods.

Analyzing our patient demographics provided valuable insights. The data underscores that a majority, 67.29% (n=72), of our study population were females. This trend resonates with data from the US where female hospital admissions for APN are much more common. However, when contrasted with the broader statistic that men face more severe outcomes from APNs, it emphasizes the intricate nature of gender-related factors and their potential influence on treatment and outcomes [1] – [3].

An essential observation was the period patients waited before seeking medical attention, averaging at 4.59 days (± 8.17). This delay raises questions about possible hindrances or perhaps a lack of awareness that may deter early medical consultation.

When exploring clinical symptoms, flank pain stood out, with 66.3% (n=71) of patients identifying it as their main complaint. Such a pattern accentuates the need for swift recognition of these symptoms to ensure prompt intervention. Furthermore, the predominance of *Escherichia coli*, present in 60.74% (n=65) of cases, underlines its role in APN within our patient group and the importance of region-specific microbial treatments.

Recognizing patients prone to extended hospitalization or severe complications was a primary concern. While past studies have identified risk factors such as weakened immunity, advancing age, and diabetes, our sample exhibited a high prevalence of diabetes at 63.5% (n=68) [4], [5]. Interestingly, our data did not correlate diabetes with extended hospital stays. Yet, due to its known connection with UTIs (Urinary Tract Infections), our strategy was to monitor diabetic patients with added caution for related complications.

A point of concern revolved around kidney complications. An obstructed and infected kidney doesn't just present an immediate problem but has potential long-term implications [4], [5]. Realizing that obstructions might diminish drug efficiency, we prioritized immediate drainage for affected patients.

From a treatment perspective, 42.05% (n=45) of our patients were managed with non-invasive measures. Yet, many

required more direct interventions, with 46.7% (n=50) undergoing Double J stent placements and 11.21% (n=12) benefiting from percutaneous nephrostomy. This variation underscores the diverse needs of APN patients and advocates for individualized therapeutic approaches.

5. Conclusion

In conclusion, intertwining our findings in this discussion illuminates the multifaceted nature of APN management. The derived insights not only enhance our comprehension of the disease's clinical intricacies but also stress the imperative for flexible, patient-focused approaches. Furthermore, our study significantly contributes to the regional data on APN, filling a gap in localized understanding and enabling more tailored, context-specific strategies for patient care. This regional insight is paramount, as global data may not always reflect local variations, and our study serves as a step toward bridging this knowledge disparity.

References

- [1] Ramakrishnan K, Schedi DC. Diagnosis and management of acute pyelonephritis in adults. *Am Fam Physician* 2005; 71: 933–942.
- [2] Stamm WE, Hooton TM. Management of urinary tract infections in adults. *N Engl J Med* 1993;329:1328-34.
- [3] Roberts FJ, Geere IW, Coldman A. A three-year study of positive blood cultures, with emphasis on prognosis. *Rev Infect Dis* 1991;13:34-6.
- [4] Efstathiou SP, Pefanis AV, Tsioulos DI, et al. Acute pyelonephritis in adults: prediction of mortality and failure of treatment. *Arch Int Med* 2003;163:1206-12.
- [5] Pertel PE, Haverstock D. Risk factors for a poor outcome after therapy for acute pyelonephritis. *BJU Int* 2006;98:141-7.
- [6] Warren, J.W.; Abrutyn, E.; Hebel, J.R.; Johnson, J.R.; Schaeffer, A.J.; Stamm, W.E. Guidelines for Antimicrobial Treatment of Uncomplicated Acute Bacterial Cystitis and Acute Pyelonephritis in Women. *Clin. Infect. Dis.* 1999, 29, 745–758.
- [7] Bailey, R.R.; Lynn, K.L.; Robson, R.A.; Smith, A.H.; Maling, T.M.; Turner, D.M.S.A. Renal Scans in Adults in Acute Pyelonephritis. *Clin. Nephrol.* 1996, 46, 99–104.
- [8] Fraser, I.R.; Birch, D.; Fairley, K.; John, S.; Lichtenstein, M.; Tress, B.; Kincaid-Smith, P.S. A Prospective Study of Cortical Scarring in Acute Febrile Pyelonephritis in Adults: Clinical and Bacteriological Characteristics *Clin. Nephrol.* 1995, 43, 159–164.
- [9] Wallin, L.; Bajc, M. Typical Technetium Dimercaptosuccinic Acid Distribution Pattern in Acute Pyelonephritis. *Acta Paediatr.* 1993, 82, 1061–1065.
- [10] Sattari, A.; Kampouridis, S.; Damrym, N.; Hainaux, B.; Ham, H.R. Vandewalle, J.C.; Mols, P. CT and ^{99m}Tc-DMSA Scintigraphy in Adult Acute Pyelonephritis: A Comparative Study. *J. Comput. Assist. Tomogr.* 2000, 24, 600–604.

Author Profile

Dr. Elumalai commenced his medical journey at the renowned Chengalpattu Medical College, from where he attained his M.B.B.S. degree in 2009. His thirst for surgical knowledge led him to Madurai Medical College, where he secured an M.S. degree, graduating in 2014. Following his M.S. degree, Dr. Elumalai embraced the role of Assistant Professor in General Surgery at Government Villupuram Medical College. Over a period of 5.5 years, he imparted surgical wisdom, bridging the gap between theory and practice for numerous medical students. Dr. Elumalai is currently delving deeper into the intricacies of Urology, pursuing an M.Ch. at his alma mater, Chengalpattu Medical College. He continues to amalgamate his vast surgical experience with advanced urological training. His endeavours promise to further augment the standards of urological care and education.