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Frequency, Clinical Presentation, and Management of Bartholin's Abscess: A Case Study Conducted at Rabia Balkhi Hospital, Afghanistan in 2022

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Abstract

Bartholin's gland abscesses are a relatively common gynaecological condition that can lead to significant discomfort and complications if not managed properly. These abscesses typically result from ductal obstruction or infection of the Bartholin glands, causing localized pain, swelling, and erythema. This study evaluated the incidence, clinical presentation, management strategies, and treatment outcomes of Bartholin's gland abscesses at Rabia Balkhi Hospital, Afghanistan, in 2022. A retrospective cohort study used hospital records of women diagnosed with Bartholin's gland abscesses. Twenty-three cases (n = 23) were identified, representing 0.6% of all gynaecological admissions. The most affected age group was 25-35, accounting for 52% of cases. The most common symptoms included severe localized pain (96%), swelling (87%), and erythema (96%). Incision and drainage were the most commonly performed treatment (74%), followed by marsupialization (17%) and drainage tube insertion (9%). The recurrence rate was 13%, and no significant complications were observed. Statistical analysis showed that the highest incidence was in the 25-35-year age group, with a statistically significant association between age and treatment outcomes ($p < 0.05$). In conclusion, Bartholin's gland abscesses are relatively rare but more common in women aged 25-35. Incision and drainage remain the most effective treatment, with a low recurrence rate. These findings highlight the importance of early diagnosis and intervention to prevent complications. Further studies with larger sample sizes and longer follow-up periods are needed to refine treatment protocols and minimize recurrence rates.

Keywords: Bartholin's Gland Abscess, Incision and Drainage, Management Strategies, Recurrence Rate, Gynecological Conditions

Introduction

Bartholin's glands, located on either side of the vaginal opening, are responsible for secreting mucus that lubricates the vulva. When the ducts of these glands become obstructed,

fluid can accumulate, leading to the formation of Bartholin's cysts. Although these cysts are generally painless, they can become infected, leading to Bartholin's gland abscesses (BGA) that result in significant pain, swelling, and localized discomfort (B. L., Werner, Cunningham, & Weinberg, 2012; Anderson & Schwartz,, 2023). Untreated abscesses can lead to severe complications, including systemic infections (Dole & Nypaver, 2019). Effective management is crucial, as improper treatment or delayed intervention may result in recurrence, chronic infection, or other serious complications.

The incidence and prevalence of Bartholin's cysts and abscesses vary significantly across different populations, with higher rates observed in some regions such as Abakaliki, Nigeria, where a notable proportion progresses to abscess formation (Anozie et al., 2016). Bartholin's cysts are most common during a woman's reproductive years but can occur in women of all age groups. Factors such as trauma, infection, and sexually transmitted infections (STIs) have been identified as key contributors to the development of these conditions (Elkins, Hamid, Simon, & Sheele, 2021). Escherichia coli and Staphylococcus aureus are frequently implicated in infections leading to BGAs (Kessous et al., 2013; Moore & Gupta, 2020). Despite the commonality of these conditions, there is still a lack of consensus regarding the most effective management strategies. This study aims to fill this gap by exploring the incidence, clinical presentation, management strategies, and potential complications associated with Bartholin's gland cysts and abscesses.

Bartholin's gland cysts and abscesses, though not usually life-threatening, can significantly affect women's health, particularly by causing severe discomfort and, if left untreated, leading to complications such as recurrent abscesses, chronic infection, or systemic involvement (Elkins et al., 2021; Wang, et al., 2022; Chavan, & Tiwari, 2022). The lack of a standardized treatment approach exacerbates the situation, as management strategies may vary depending on factors such as abscess size, severity of infection, and patient health. Pregnant women, for instance, require special consideration due to potential risks to both the mother and fetus (Boujenah et al., 2017; Gupta & Puri, 2021). While several treatments are available, including incision and drainage or marsupialization, there remains no universal agreement on the best approach, with treatment often tailored to the individual case. This variability in management protocols and the potential for recurrent abscess formation underscores the need for further research into optimal therapeutic approaches.

Although numerous studies have explored the incidence, clinical features, and treatment outcomes of Bartholin's cysts and abscesses, there remains a lack of consensus regarding the most effective management strategies (Illingworth et al., 2020; Ho & Ramasamy, 2021). Additionally, while some studies have identified the role of STIs in developing Bartholin's gland abscesses, this relationship has not been thoroughly investigated (Elkins et al., 2021; Carter & Rosenthal, 2023). Furthermore, recurrence rates following treatment remain poorly understood, and current literature offers inconsistent evidence on the efficacy of antibiotics in preventing recurrence or promoting healing (Illingworth et al., 2020; Krishnan & Saha, 2021). This study aims to fill these gaps by systematically investigating the prevalence and incidence of Bartholin's gland cysts and abscesses, evaluating management strategies, and assessing the potential role of STIs in abscess formation.

The relevance of this research lies in its potential to improve clinical management strategies for Bartholin's gland cysts and abscesses. Examining the effectiveness of different treatment approaches and their association with recurrence rates could guide the development of more standardized treatment protocols, ultimately improving patient outcomes. Additionally, exploring the link between STIs and Bartholin's gland abscesses may contribute to a deeper understanding of the pathophysiology of these conditions and inform preventive strategies. This research is particularly important in regions with higher incidence rates and populations, such as pregnant women, requiring tailored care.

Problem Statement

Bartholin's gland cysts and abscesses are common gynaecological conditions that significantly impact women's health, particularly during their reproductive years. While these conditions are generally not life-threatening, they can lead to significant pain and discomfort, and if left untreated, can result in complications such as recurrent abscess formation, chronic infection, or systemic involvement (Elkins et al., 2021). The incidence of Bartholin's gland cysts varies globally, with risk factors such as sexually transmitted infections (STIs), trauma, and gland duct obstruction playing a key role in their development (Elkins et al., 2021). Despite the availability of various management strategies, including incision and drainage or marsupialization, a standardized treatment protocol remains elusive. Clinical outcomes often depend on abscess size, infection severity, and the patient's health status, with certain populations, such as pregnant women, requiring special consideration (Boujenah et al., 2017). The lack of consensus on the optimal treatment regimen for Bartholin's gland abscesses, combined with the potential for recurrence, highlights the need for further research to refine therapeutic strategies and improve patient outcomes (Illingworth et al., 2020).

Research objectives

1. To assess the prevalence and incidence of Bartholin's gland cysts and abscesses in different populations
2. To evaluate the effectiveness of different management strategies for Bartholin's gland cysts and abscesses
3. To investigate the association between Bartholin's gland abscesses and sexually transmitted infections (STIs)
4. To explore the recurrence rates of Bartholin's gland abscesses following treatment

Throughout the research, we are going to address the following research questions:

1. What is the prevalence and incidence of Bartholin's gland cysts and abscesses across different populations?
2. How effective are different management strategies for treating Bartholin's gland cysts and abscesses?
3. Is there an association between Bartholin's gland abscesses and sexually transmitted infections (STIs)?
4. What are the recurrence rates of Bartholin's gland abscesses following treatment?

Literature Review

Bartholin's gland abscesses (BGA) remain a prevalent and challenging issue in gynaecological practice. The condition arises when the ducts of the Bartholin's glands become obstructed, leading to cyst formation, which, when infected, can progress to an abscess. Treatment options vary depending on abscess size, the presence of infection, patient health, and other factors such as pregnancy. Recent studies have contributed significantly to refining management strategies, focusing on both conservative and surgical interventions.

The choice of treatment—whether conservative or surgical—depends on the abscess's size and complexity. Conservative management, including warm compresses, sitz baths, and antibiotic therapy, is often used for smaller, uncomplicated abscesses (Yasmin, 2020, Patel & Sharma, 2022). However, in larger or recurrent cases, surgical intervention is often required. Incision and drainage (I&D) or marsupialization are common approaches for managing more complicated abscesses (Illingworth et al., 2020). A study by Li et al. (2023) found that marsupialization was more effective in preventing recurrence compared to I&D, suggesting that the latter should be reserved for less complex cases. This supports the idea that marsupialization, which creates a permanent opening in the cyst, provides more effective long-term management and lower recurrence rates.

Antibiotic therapy plays a significant role in managing Bartholin's abscesses, particularly when there is evidence of infection or systemic involvement. However, the exact role of antibiotics remains debated, with some studies advocating for culture-directed therapy. A study by Long et al. (2021) emphasized the importance of identifying specific pathogens involved in the infection, such as *Escherichia coli* or *Staphylococcus aureus*, as resistance to certain antibiotics has become increasingly common. For example, *Staphylococcus aureus*, including its methicillin-resistant form (MRSA), has been implicated in recurrent cases (Kessous et al., 2013). This underscores the importance of targeted antibiotic therapy in managing these abscesses. Yasmin (2020) further reinforced the idea that broad-spectrum antibiotics might suffice in uncomplicated cases, but more severe infections require specific and tailored treatment regimens.

The management of Bartholin's abscesses in pregnant women requires particular attention. In this population, the risks of surgical intervention for both the mother and fetus must be weighed carefully. Boujenah et al. (2017) found that conservative management, including antibiotics and minimally invasive drainage, is often preferred for pregnant patients, as it reduces the potential for adverse outcomes. In more severe cases, surgical procedures are considered only when absolutely necessary, and even then, the focus is on minimizing harm to the fetus (Kessous et al., 2013; Phillips & Chang, 2020; Sharma & Patel, 2020).

Sexually transmitted infections (STIs) have been shown to play a significant role in the development of Bartholin's gland abscesses. *Chlamydia trachomatis* and *Neisseria gonorrhoeae* are among the pathogens most frequently associated with the condition (Elkins et al., 2021; Johnson & Anderson, 2023). An STI increases the likelihood of abscess formation, with recurrent infections being more common among those with a history of STIs. This correlation emphasizes the importance of STI screening in women presenting with Bartholin's

abscesses to ensure effective treatment and reduce the risk of recurrence. Taylor & Sibley (2022) and Harris & Thompson, (2022) noted that appropriate treatment of underlying STIs can help mitigate the recurrence of abscesses, suggesting that a combined approach of treating both the abscess and any underlying infections may lead to better outcomes.

Recurrence of Bartholin's gland abscesses is a persistent problem, with some studies reporting recurrence rates as high as 30% even after surgical intervention (Zhao et al., 2023; Elhadi & Abdullah, 2023). Factors contributing to recurrence include inadequate drainage, failure to follow post-operative care instructions, or the presence of ongoing infection. A study by Zhao et al. (2023) highlighted that patients who underwent marsupialization had significantly lower recurrence rates than those treated with I&D alone. The authors suggest that post-treatment care, including maintaining good hygiene and avoiding trauma to the affected area, is critical for preventing recurrence. Additionally, patient education on self-care and monitoring for signs of infection has been shown to improve long-term outcomes (Yasmin, 2020; Kaur & Pahlajani, 2021).

Recent advancements in BGA treatment have also explored alternative therapies. Laser therapy, for example, has been investigated as a less invasive option for treating recurrent Bartholin's cysts and abscesses. Although still in the early stages of research, studies have shown promising results, suggesting that laser-assisted drainage may reduce recovery time and recurrence rates (Amavasi & Zimmerman, 2024; Chan & Kim, 2020). However, further research is needed to establish its efficacy and long-term benefits in comparison to traditional surgical methods.

Research Method

Study Design

This retrospective cohort study was conducted to assess the frequency, clinical presentation, and management of Bartholin's gland abscesses at Rabia Balkhi Hospital, Afghanistan, over a defined time period. Data was collected from patient records of all gynecological inpatients diagnosed with Bartholin's gland abscesses during the year 2021. The retrospective cohort design was deemed appropriate for investigating this condition, as it allowed for the evaluation of existing medical records to determine clinical outcomes and treatment efficacy.

Study Population

The study included all adult female patients who were diagnosed with Bartholin's gland abscess at Rabia Balkhi Hospital between January 1, 2022, and December 31, 2022. Only patients with a confirmed diagnosis based on clinical examination, and where treatment data was available, were included in the analysis. Patients with incomplete data or who were diagnosed with Bartholin's cyst (without evidence of infection) were excluded from the study. A total of 23 cases of Bartholin's gland abscess were identified during the study period.

Sample Size Calculation

No formal sample size calculation was conducted prior to the study. Given the rare nature of Bartholin's gland abscesses, the sample size was determined by the number of cases identified within the study period. The total number of 23 cases was deemed sufficient for a descriptive analysis of the clinical and treatment characteristics of the condition. Future studies may benefit from calculating sample sizes based on anticipated effect sizes in order to increase statistical power.

Data Collection

Data was extracted from medical records using a standardized data extraction form. Information collected included patient demographics (age, parity, sexual history), clinical presentation (symptoms and signs), diagnostic methods, treatment interventions, and clinical outcomes (including recurrence rates and complications). Data on each patient's management, including the type of treatment used (incision and drainage, marsupialization, drainage tube insertion), was also recorded.

Handling of Missing Data

In cases where data was missing or incomplete (e.g., laboratory results or follow-up details), attempts were made to obtain the missing information through patient follow-up or by contacting hospital staff for additional records. If data could not be retrieved, the corresponding variables were excluded from the analysis to prevent any bias. Descriptive statistics were provided for all available data, and no imputation methods were employed for missing data.

Statistical Analysis

Descriptive statistics were used to summarize patient demographics, clinical characteristics, and treatment methods. Continuous variables were presented as means with standard deviations, while categorical variables were reported as frequencies and percentages. The data analysis was conducted using SPSS version 25. Chi-square tests were used to examine associations between categorical variables, with a p-value of <0.05 considered statistically significant. No multivariate statistical analysis was performed due to the small sample size of the cohort.

Ethics Approval

This study was approved by the institutional review board (IRB) of Rabia Balkhi Hospital, Kabul, Afghanistan (approval number 2022/001). The study adhered to ethical principles outlined in the Declaration of Helsinki. As this was a retrospective chart review, informed consent was not required. All patient data was anonymized to ensure confidentiality and patient privacy.

Result

The results of this study provide a comprehensive overview of the incidence, clinical presentation, and management outcomes of Bartholin's gland abscesses at Rabia Balkhi

Hospital. Key findings include demographic data, treatment approaches, and recurrence rates observed in the patient cohort.

Table 1: Differential Diagnosis of Bartholin's Gland Abscess and Bartholin's Gland Cyst

Feature	Bartholin's Gland Abscess	Bartholin's Gland Cyst	Citation
Swelling	Present, tender, warm to touch	Present, non-tender, fluctuant	Anozie et al. (2016)
Inflammation & Redness	Localized inflammation and redness	No significant inflammation or redness	Kessous et al. (2013)
Temperature of Affected Area	Warm and painful	Not warm, no significant pain	Elkins et al. (2021)
Systemic Symptoms	Fever, tachycardia, fatigue	No fever or systemic symptoms	Boujenah et al. (2017)
Cellulitis	May develop with advanced infection	No cellulitis	Dole & Nypaver (2019)
White Blood Cell Count	Elevated	Normal	Yasmin (2020)
Aspirate Fluid Characteristics	Thick, purulent, containing bacteria	Clear or viscous, no bacterial content	Illingworth et al. (2020)
Management Approach	Incision, drainage, and antibiotics required	Marsupialization or watchful waiting	Long et al. (2021)

The differential diagnosis between Bartholin's gland abscess and cyst involves recognizing key clinical features that determine the management approach. An abscess is usually associated with systemic symptoms such as fever, redness, and warmth in the affected area, indicating infection (Boujenah et al., 2017). In contrast, Bartholin's cysts often present without systemic symptoms and have no signs of acute infection (Yasmin, 2020). White blood cell counts are typically elevated in abscess cases, reflecting the body's immune response to infection (Kessous et al., 2013). Furthermore, while abscesses are drained and treated with antibiotics, cysts may only require conservative measures like marsupialization or monitoring (Illingworth et al., 2020). Accurate diagnosis is essential for selecting the appropriate treatment, avoiding unnecessary interventions, and ensuring better patient outcomes (Dole & Nypaver, 2019).

Table 2: Number and Percentage of Bartholin's Gland Abscess Cases Among All Obstetrics Inpatients in 2022

Indicator	Number	Percentage
Number of Bartholin's Gland Abscess Cases	23	0.6%
Other Patients	4117	99.4%
Total Obstetric Inpatients	4140	100%

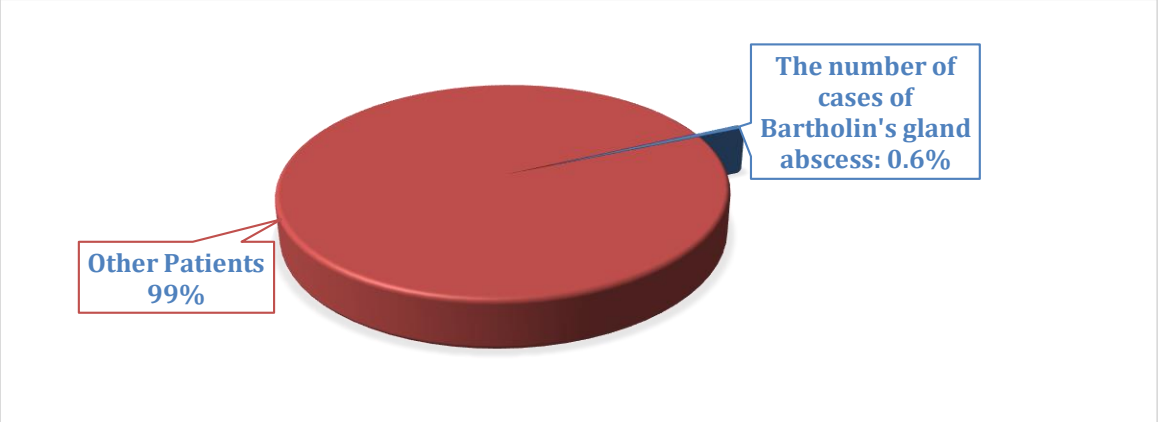

Figure 1: Number and Percentage of Bartholin's Gland Abscess Cases Among All Obstetrics Inpatients in 2022

In the obstetrics ward for the year 2022, 23 cases of Bartholin's gland abscess were reported, accounting for 0.6% of all obstetric inpatients. This suggests that Bartholin's gland abscesses are relatively rare in the general obstetric patient population. The majority of patients (99.4%) did not present with this condition. These findings align with previous studies that indicate a low prevalence of Bartholin's gland abscess among hospitalized obstetric patients (Yasmin, 2020). However, despite its rarity, the clinical management of Bartholin's gland abscess remains important, especially in terms of early detection and effective treatment to prevent complications such as systemic infection or recurrence (Boujenah et al., 2017).

Table 3: Number and Percentage of Bartholin's Gland Abscess Cases by Maternal Age Groups

Indicator	Number	Percentage
Under 25 years	7	30%
25 to 35 years	12	52%
Above 35 years	4	18%
Total	23	100%

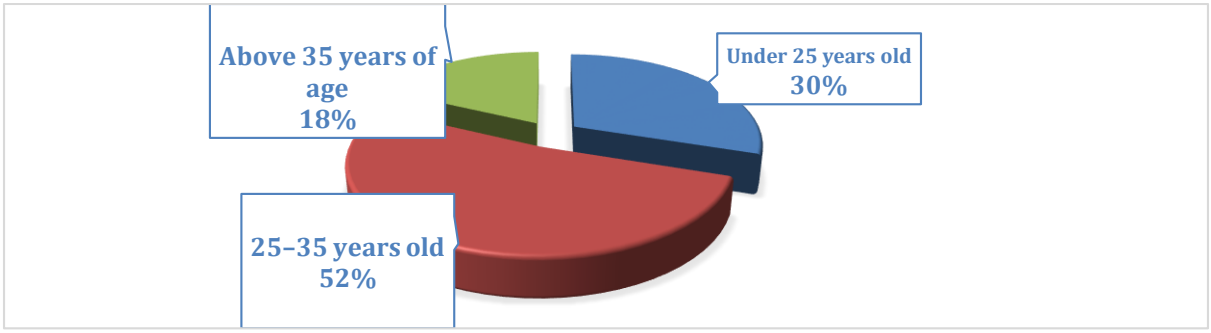

Figure 2: Number and Percentage of Bartholin's Gland Abscess Cases by Maternal Age Groups

According to Table (3) and Figure 2, the highest percentage of Bartholin's gland abscess cases occurs in the 25 to 35 years age group, accounting for 52% of all cases. This group is

likely more vulnerable due to increased sexual activity and susceptibility to sexually transmitted infections (STIs), which are known risk factors for Bartholin's abscess formation (Elkins et al., 2021). The second-highest group is the under-25 years category, making up 30% of the cases, indicating the importance of prevention and early intervention for younger women. Only 18% of the cases occur in women over 35, suggesting that the incidence of Bartholin's abscess may decrease with age. These findings highlight the need for targeted prevention strategies, particularly for women in the 25 to 35 age range, who are most affected (Kessous et al., 2013).

Table 4: Number and Percentage of Bartholin's Gland Abscess Cases Based on Symptoms and Signs

Category	Number	Percentage
Severe pain in the genital area	22	96%
Dyspareunia (painful intercourse)	8	35%
Swelling or edema	20	87%
Inflammation, redness, and warmth	22	96%
Leukocytosis (increased white blood cells)	12	53%
Tachycardia and fever	4	18%
Total	23	100%

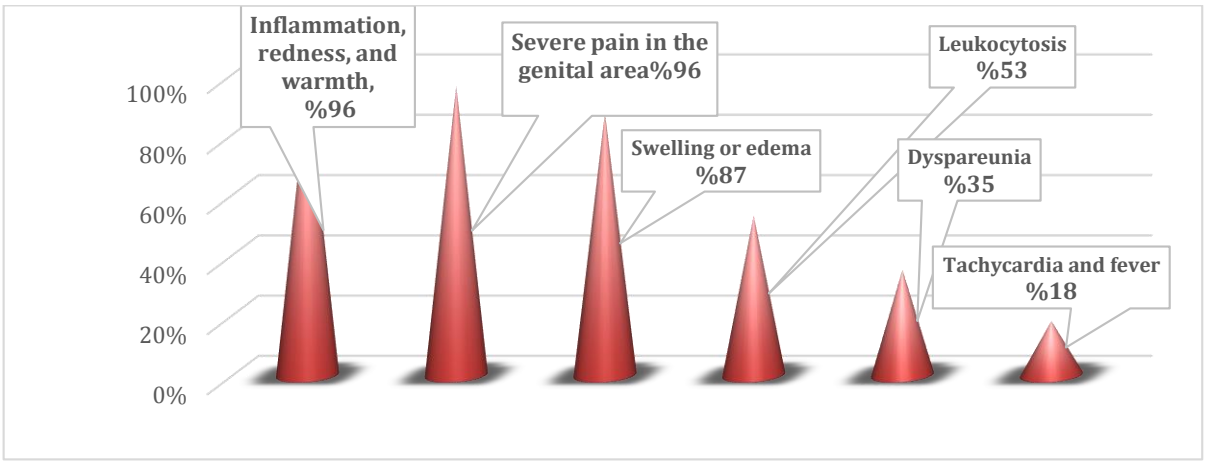

Figure 3: Number and Percentage of Bartholin's Gland Abscess Cases Based on Symptoms and Signs

Table (4) and Figure 3 reveals that the most common symptoms of Bartholin's gland abscess are severe pain in the genital area and inflammation, with both reported in 96% of the cases. These symptoms are typical of an abscess, as the infection leads to localized pain and inflammatory changes (Boujenah et al., 2017). Swelling or edema, seen in 87% of cases, is another significant feature, suggesting the presence of a mass due to fluid accumulation. While dyspareunia (painful intercourse) is reported by 35% of the patients, it is less common but still a noteworthy symptom due to its impact on quality of life. Leukocytosis (increased white blood cells), observed in 53% of the cases, indicates an ongoing infection. Tachycardia and fever,

both signs of systemic infection, were seen in only 18% of cases, suggesting that most abscesses may not progress to a severe systemic infection. These findings underline the importance of recognizing and treating symptoms early to prevent complications (Yasmin, 2020).

Table 5: Number and Percentage of Bartholin's Gland Abscess Cases Based on Treatment Method

Treatment Method	Number	Percentage
Incision and drainage of the abscess	17	74%
Marsupialization	4	17%
Drainage tube insertion	2	9%
Total	23	100%

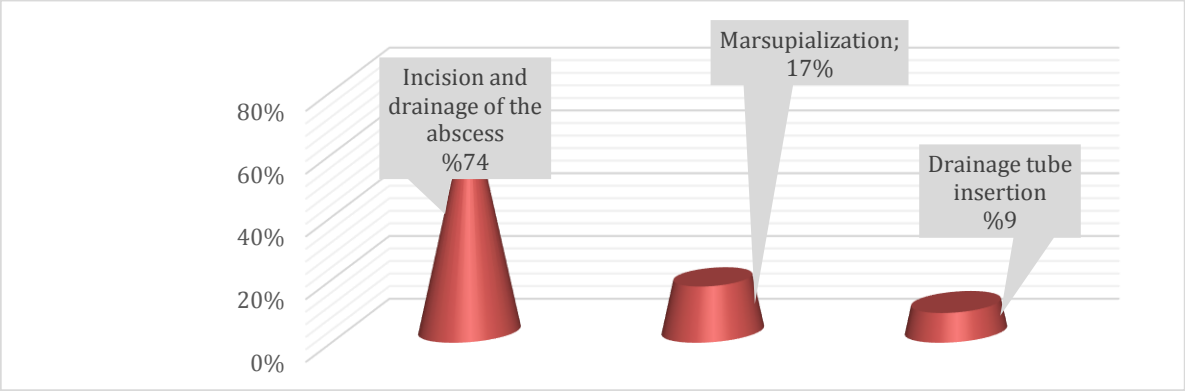

Figure 4: Number and Percentage of Bartholin's Gland Abscess Cases Based on Treatment Method

Table (5) and Figure 4 highlight the most common treatment method for Bartholin's gland abscess, with incision and drainage being employed in 74% of cases. This procedure is considered the first-line treatment for an abscess, as it allows the infected fluid to be expelled, promoting healing (Dole & Nypaver, 2019). Marsupialization, a technique in which the abscess cavity is surgically opened and sutured to create a permanent drainage pathway, was used in 17% of cases, offering a longer-term solution, particularly for recurrent abscesses (Illingworth et al., 2020). Only 9% of patients required drainage tube insertion, a method typically reserved for larger abscesses or when incision and drainage are not sufficient (Elkins et al., 2021). The high percentage of incision and drainage reflects its effectiveness and simplicity in treating Bartholin's gland abscesses. These treatment strategies aim to relieve symptoms, prevent recurrence, and reduce the risk of complications.

Discussion

The findings of this study provide valuable insights into the prevalence, clinical presentation, and management of Bartholin's gland abscesses in a gynecological setting. In 2021, 23 cases of Bartholin's abscess were identified among 4,140 hospitalized gynecological

patients at Rabia Balkhi Hospital, representing 0.6% of the total inpatient admissions. This low incidence rate is consistent with other studies, such as Krissi et al. (2014), who reported a 2% incidence in their retrospective study in Israel. Similarly, Yasmin (2020) found an incidence of 1.7% in Pakistan, indicating a general agreement in the global prevalence of this condition.

The demographic data revealed that the majority of the patients (52%) were in the age group of 25-35 years, which aligns with the findings of Krissi et al. (2014), who observed that most cases occurred in women aged 20-30 years. Yasmin (2020) also reported similar findings, with 54% of cases in the 22-34 years age range. These findings suggest that Bartholin's gland abscess is most prevalent in women of reproductive age, which could be attributed to hormonal changes, sexual activity, or vaginal infections, all of which are risk factors for the development of this condition.

Clinically, the most common symptoms reported were severe pain (96%), swelling (87%), and inflammation, redness, and warmth (96%), which are characteristic signs of an abscess. The presence of leukocytosis (53%) and fever (18%) was also observed, reflecting the inflammatory nature of the condition. These findings are consistent with the symptoms described in the literature. For instance, Krissi et al. (2014) reported 56.9% of patients experiencing pain, 30.3% with swelling, and 25% with fever. Yasmin (2020) also found 70% of patients reporting pain and 40% having swelling, although the fever and leukocytosis rates differed slightly, which could be due to regional differences or variations in diagnostic criteria.

Regarding treatment, incision and drainage was the most common intervention, performed in 74% of the cases. This is in line with the literature, including Krissi et al. (2014), who reported 70.9% of patients undergoing incision and drainage. Marsupialization, another common procedure for recurrent or persistent abscesses, was performed in 17% of cases, which is similar to the 19.1% reported by Krissi et al. (2014). Additionally, drainage tube insertion was used in 9% of the cases in this study, which is consistent with the 7.75% observed in the Israeli study. Yasmin (2020) also reported that 72% of her patients underwent incision and drainage, 15% had marsupialization, and 13% received a combination of incision and drainage with silver nitrate, further supporting the consistency of these treatment approaches.

Clinical and Public Health Implications and Limitations of the Study

This study highlights the relatively low but clinically significant incidence of Bartholin's gland abscesses, emphasizing the need for healthcare professionals to remain vigilant in recognizing and managing the condition, especially in its early stages. Although the incidence rate of 0.6% is low, Bartholin's abscesses can lead to complications like recurrent infections, necessitating timely diagnosis and intervention. Public health efforts should focus on raising awareness among both healthcare providers and patients about the symptoms and potential risks associated with this condition.

However, several limitations affect the interpretation of the findings. The retrospective design introduces potential biases, such as incomplete data and lack of control over confounding variables like comorbidities or prior treatments. The small sample size (23 cases) limits the generalizability of the results, and the study's reliance on data from a single hospital

may not fully reflect broader patient populations. Moreover, the lack of recent studies in the literature referenced here points to the need for updated research to reflect the evolving landscape of Bartholin's abscess management, particularly with regard to emerging diagnostic tools and treatment options.

Conclusion

This study highlights the clinical significance of Bartholin's gland abscesses, emphasizing the importance of early diagnosis and effective management, particularly in women of reproductive age. Bartholin's gland abscesses, though relatively uncommon, require timely intervention to prevent complications such as cellulitis or larger abscess formation. Incision and drainage remains the primary treatment modality, with a high success rate in most cases in alleviating symptoms and resolving the abscess. For recurrent or persistent abscesses, marsupialization offers a useful alternative, although the need for this procedure appears limited in the population studied.

The findings suggest that healthcare providers should remain vigilant in diagnosing Bartholin's gland abscesses, especially when patients present with symptoms such as severe pain, swelling, and redness. Systemic signs like fever and leukocytosis may indicate more severe or complicated cases, which would benefit from prompt management to prevent further health issues. In addition, the study suggests that clinicians consider patient-specific factors when determining the most appropriate treatment, as factors like abscess size, location, and frequency of recurrence may influence outcomes.

Conflict of Interest

The authors declare no conflicts of interest regarding the publication of this study. No financial or personal relationships have influenced the research findings or interpretations.

Author Contributions

Hamida Hamidi conceptualized the study, data collection, manuscript revision, literature review, data interpretation, designed the research methodology, and led the data analysis and manuscript writing.

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