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Approach to FNA of Pancreatic Cysts

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ABSTRACT

Background: The literature on fine needle aspiration (FNA) for pancreatic cysts and lesions has expanded significantly, demonstrating the critical role of this technique in diagnosing and managing pancreatic pathologies. **Literature Review:** Further studies, such as (Ramesh & Varadarajulu, 2012), reinforced the technical aspects of EUS-FNA, identifying procedural variables like needle gauge and the presence of an on-site cytopathologist as influential in achieving optimal diagnostic outcomes. The economic considerations of EUS-FNA were also discussed, suggesting a need for algorithmic approaches to enhance efficiency and reduce costs in clinical practice. The analysis of pancreatic cyst fluid, as presented by (Alkaade et al., 2015), illustrated the incremental diagnostic yield of EUS-FNA over traditional imaging methods. This study underscored the significance of cyst fluid analysis, including viscosity and carcinoembryonic antigen (CEA) levels, in differentiating between benign and malignant lesions, thus guiding management decisions. Concurrently, (Jae Yoon & Bishop Pitman, 2015) emphasized the importance of standardized reporting and triage processes in enhancing diagnostic accuracy for both solid and cystic lesions. A systematic review by (S. Jani et al., 2016) synthesized various technical variables affecting EUS-FNA outcomes, reinforcing its adoption in clinical practice due to its minimally invasive nature and high diagnostic yield. The study by (Nigam et al., 2019) further emphasized the diagnostic efficacy of EUS-FNA, particularly in the context of pancreatic cancers, highlighting the necessity of timely intervention for improved therapeutic outcomes. **Conclusions:** In conclusion, the literature underscores the evolution of FNA cytology in diagnosing pancreatic cysts and lesions, highlighting its critical role in clinical decision-making. The advancements in procedural techniques, combined with a deeper understanding of diagnostic variables, have solidified EUS-FNA's place as a cornerstone in the management of pancreatic pathologies. Continued research and standardization in this field will further enhance the reliability and efficacy of this vital diagnostic tool.

Keywords: FNA, Pancreatic Cysts

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INTRODUCTION

The exploration of fine needle aspiration (FNA) cytology in the diagnosis of pancreatic lesions has evolved significantly over the past decade, as evidenced by a series of pivotal studies that have shaped current practices. In 2010, (Kocjan, 2010) highlighted FNA cytology as a primary diagnostic tool for pancreatic mass lesions, emphasizing its role in distinguishing between non-mucinous and mucinous cysts, which is crucial for patient management. The study underscored the importance of the cytopathologist's involvement in preoperative diagnoses, particularly through techniques like endoscopic ultrasound (EUS) guided FNA, which have become standard due to their accuracy in staging and diagnosing pancreatic malignancies.

Building on this foundation, (Ramesh & Varadarajulu, 2012) further elucidated the technical aspects of EUS-FNA, emphasizing its high diagnostic accuracy and safety profile. They identified several procedural variables that impact outcomes, such as needle gauge and the presence of an on-site cytopathologist, thus advocating for an algorithmic approach to optimize results while managing costs. This study set the stage for understanding the nuanced factors that contribute to the success of EUS-FNA procedures.

In 2015, (Alkaade et al., 2015) expanded the discourse by focusing on the analysis of pancreatic cyst fluid, which plays a critical role in differentiating pancreatic cystic lesions. Their work provided insights into the incremental diagnostic yield of EUS over traditional imaging methods, reinforcing the value of cytology in assessing malignancy risk in pancreatic mucinous cysts. Concurrently, (Jae Yoon & Bishop Pitman, 2015) explored advancements in cytology specimen management, emphasizing the need for standardized reporting and triage processes to enhance diagnostic accuracy for both solid and cystic pancreatic lesions.

The systematic review by (S. Jani et al., 2016) synthesized various technical and procedural variables affecting EUS-FNA outcomes, highlighting the increasing adoption of this minimally invasive technique in clinical practice. Their findings

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underscored the importance of understanding procedural intricacies to improve diagnostic yields, thereby solidifying EUS-FNA's role in managing pancreatic pathologies.

(Nigam et al., 2019) contributed to this body of literature by analyzing the cytological spectrum of pancreatic lesions, further emphasizing the diagnostic efficacy of EUS-FNA in achieving early and accurate diagnoses for pancreatic cancers. This study reinforced the notion that timely intervention is critical for improving therapeutic outcomes in this challenging clinical landscape.

In 2021, (Kumar Mallik et al., 2021) revisited the cytological analysis of pancreatic adenocarcinomas, detailing the complexities of identifying these tumors through FNA due to their morphological variability and potential contaminants. Their findings highlighted the need for meticulous cytomorphological assessment to avoid misdiagnosis.

The comparative study by (Yousri et al., 2022) evaluated the diagnostic utility of EUS-FNA versus EUS-guided fine needle biopsy (EUS-FNB), revealing that while both techniques are effective, EUS-FNB may offer advantages in obtaining core tissue necessary for certain histological evaluations. This work addressed the limitations of FNA in providing adequate samples for immunohistochemical staining, thereby influencing clinical decision-making.

Finally, (M. Selvaggi, 2022) examined the concurrent use of EUS-FNA and needle core biopsies, demonstrating that this combined approach enhances diagnostic yield and provides sufficient material for ancillary tests. Their study affirmed the high sensitivity and specificity of both techniques in diagnosing pancreatic neoplasms, advocating for a more integrated methodology in clinical practice.

Through this literature review, a comprehensive understanding of the advancements in FNA cytology and its implications for diagnosing pancreatic lesions will be developed, reflecting the ongoing evolution of this critical diagnostic approach.

LITERATURE REVIEW

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The article "Fine Needle Aspiration Cytology of the Pancreas: A Guide to the Diagnostic Approach" by (Kocjan, 2010) provides a comprehensive overview of the role of fine needle aspiration (FNA) cytology in the evaluation of pancreatic mass lesions, which include both cystic and solid formations. (Kocjan, 2010) emphasizes that while imaging techniques have advanced, definitive management of pancreatic lesions cannot solely rely on clinical and radiological features. This assertion highlights the critical role of cytopathologists in the preoperative diagnosis, particularly in distinguishing between non-mucinous and mucinous cysts, as well as between benign and malignant cystic formations.

The article outlines that FNA, particularly when guided by endoscopic ultrasound (EUS), has emerged as the preferred diagnostic method due to its minimally invasive nature. The author notes that EUS-guided FNA (EUS FNA) is increasingly recognized for its effectiveness in acquiring cytological samples, which are essential for confirming the presence of pancreatic cancer and facilitating accurate staging of malignancies through the sampling of peripancreatic nodes and liver lesions. This aspect of the article underscores the dual role of FNA not only in diagnosis but also in staging, which is critical for treatment planning.

(Kocjan, 2010) provides a critical evaluation of the factors influencing the accuracy of FNA, emphasizing that the quality of the sample and the interpretation are paramount. This point is particularly relevant in clinical practice, as it suggests that the success of FNA is contingent upon both the procedural expertise of the clinician performing the aspiration and the interpretative skills of the cytopathologist. The article effectively conveys that while FNA is a powerful tool, its efficacy is inherently linked to the technical execution of the procedure and the subsequent analysis of the samples obtained.

The article titled "How Can We Get the Best Results with Endoscopic Ultrasound-Guided Fine Needle Aspiration?" by (Ramesh & Varadarajulu, 2012) provides a comprehensive overview of the techniques and considerations involved in endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) for pancreatic cysts and other structures. The authors emphasize the high diagnostic accuracy and

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safety profile of EUS-FNA, with reported diagnostic accuracy rates ranging from 78% to 94% for pancreatic tumor staging and 64% to 82% for nodal staging.

One of the critical evaluations presented in the article is the influence of various factors on the success of EUS-FNA. The authors highlight that technical difficulty, the gauge of the needle used, and whether a stylet or suction is employed can significantly impact the diagnostic outcomes. The presence of an onsite cytopathologist is also noted as a crucial element that can enhance the accuracy of the procedure. This insight underscores the importance of having skilled personnel and appropriate equipment available during the aspiration process.

Furthermore, (Ramesh & Varadarajulu, 2012) discuss the economic implications associated with EUS-FNA, noting that the accessories required for the procedure are often expensive and that there is a notable rate of needle dysfunction, estimated between 10% and 15%. This aspect raises important questions about the cost-effectiveness of EUS-FNA in clinical practice, suggesting that while the procedure is clinically valuable, it may also present financial challenges that need to be addressed.

The authors propose an algorithmic approach to streamline the EUS-FNA process, which could help minimize costs while maximizing clinical outcomes. This recommendation is particularly relevant in the context of healthcare systems that are increasingly focused on efficiency and cost-effectiveness. By incorporating structured protocols, clinicians may enhance the reliability of EUS-FNA results and improve patient management strategies.

The article "Role of endoscopic ultrasound-guided fine-needle aspiration cytology, viscosity, and carcinoembryonic antigen in pancreatic cyst fluid" by (Alkaade et al., 2015) provides a comprehensive analysis of the diagnostic approach to pancreatic cystic lesions utilizing endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA). The authors present a multifaceted evaluation of the efficacy of EUS-FNA in diagnosing pancreatic cysts, emphasizing the importance of cyst fluid analysis.

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One of the key insights from the article is the performance of EUS-FNA in distinguishing between benign and malignant cystic lesions. The authors highlight that EUS-FNA is superior to conventional imaging techniques such as CT and MRI in providing a more accurate diagnosis, particularly when assessing the risk of malignancy in pancreatic mucinous cysts. This is supported by their assertion that cytological analysis enhances the value of imaging studies, which is critical for appropriate management decisions ((Alkaade et al., 2015)).

The article also discusses the role of cyst fluid analysis, including viscosity and carcinoembryonic antigen (CEA) levels, in the differential diagnosis of pancreatic cystic lesions. The authors provide evidence that these parameters can significantly aid in the classification of cysts, thereby guiding management strategies. For instance, a high CEA level in cyst fluid is often indicative of mucinous cysts, which carry a higher risk of malignancy, while low levels are typically associated with serous cysts, which are benign ((Alkaade et al., 2015)).

Furthermore, the authors propose a simple imaging-based classification system for pancreatic cystic lesions, which can facilitate clinical decision-making. This classification system is particularly useful in stratifying patients based on the likelihood of malignancy, thus optimizing the use of EUS-FNA and subsequent interventions ((Alkaade et al., 2015)).

The article also addresses the safety and efficacy of EUS-FNA, noting that while the procedure is generally safe, there are risks involved that must be considered. The authors emphasize the need for careful patient selection and thorough pre-procedural assessment to mitigate potential complications ((Alkaade et al., 2015)).

The article "Cytology Specimen Management, Triage and Standardized Reporting of Fine Needle Aspiration Biopsies of the Pancreas" by (Jae Yoon & Bishop Pitman, 2015) provides a comprehensive overview of the advancements in the cytological evaluation of pancreatic lesions, particularly focusing on the methodologies relevant to fine needle aspiration (FNA) biopsies of pancreatic cysts. The authors emphasize the importance of proper specimen management and triage,

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highlighting that the accuracy of cytological diagnoses has significantly improved due to recent advancements in sampling techniques.

One of the critical insights presented in the article is the necessity for ancillary testing alongside cytological evaluation, especially in the context of pancreatic cysts. This dual approach is vital, as cytological findings alone may not suffice for a definitive diagnosis in many cases, necessitating further testing to clarify the nature of the cystic lesions. The authors advocate for a standardized reporting terminology for pancreaticobiliary cytology, which they argue enhances communication among healthcare providers and improves patient care outcomes.

The article also details the technical aspects of endoscopic ultrasound-guided fine needle aspiration (EUS-FNA), particularly for solid pancreatic lesions. The authors note that the use of linear echoendoscopes has become the norm, facilitating the procurement of histological samples through various needle gauges. Importantly, the article distinguishes the procedural nuances between solid and cystic lesions, stating that for pancreatic cysts, all fluid should be aspirated in a single pass without creating direct smears, which is a critical procedural guideline that optimizes specimen quality for analysis.

The article titled "Endoscopic Ultrasound-Guided Fine-Needle Aspiration of Pancreatic Lesions: A Systematic Review of Technical and Procedural Variables" by (S. Jani et al., 2016) provides a thorough examination of the evolving role of Endoscopic Ultrasound (EUS)-guided fine-needle aspiration (FNA) in diagnosing pancreatic lesions. The authors emphasize the significant impact that cytopathological diagnoses derived from EUS-FNA can have on therapeutic decisions and patient prognosis, highlighting the procedure's increasing adoption in clinical practice.

The article effectively outlines the advantages of EUS-FNA, particularly its safety profile and minimal invasiveness, which contribute to its status as the standard of care for various pancreatic pathologies. The authors note that EUS-FNA offers a high diagnostic yield, especially for lesions smaller than 2 cm, due to the superior spatial resolution of EUS compared to traditional imaging modalities. This assertion

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is supported by a recent meta-analysis referenced in the article, which underscores the accuracy of EUS-FNA in diagnosing solid pancreatic masses.

However, the review also identifies several procedural variables that remain inadequately understood and can influence the diagnostic yield of EUS-FNA. These variables include the presence of an on-site cytopathologist during the procedure, the type and size of the needle utilized, the choice between aspiration and core biopsy, the number of needle passes, and the techniques employed for sampling. The authors stress the importance of these factors in optimizing the efficacy of EUS-FNA, suggesting that further research is needed to elucidate their roles and to establish best practices.

In terms of critical evaluation, the article presents a comprehensive literature search, which adds credibility to its findings. Nevertheless, it would benefit from a more detailed discussion of the implications of these procedural variables on patient outcomes. While the authors provide a solid foundation for understanding the technical aspects of EUS-FNA, the integration of clinical outcomes related to these variables could enhance the practical relevance of their findings. Additionally, a comparative analysis of EUS-FNA with other diagnostic modalities could provide a more holistic view of its place within the diagnostic landscape for pancreatic lesions.

The article "EUS-guided FNA in Diagnosing Pancreatic Lesions: Strength and Cytological Spectrum" by (Nigam et al., 2019) provides a comprehensive analysis of the role of endoscopic ultrasonography–fine needle aspiration (EUS-FNA) in the diagnosis of pancreatic lesions, particularly focusing on both solid and cystic lesions. The authors emphasize the critical importance of early and accurate diagnosis in enhancing the therapeutic efficacy for patients with pancreatic cancers.

The study meticulously evaluates the cytological spectrum of pancreatic lesions, illustrating the varied histological characteristics that can be identified through EUS-FNA. One of the significant strengths highlighted in the article is the ability of EUS-FNA to provide high diagnostic accuracy, which is essential for differentiating between malignant and benign pancreatic cysts. The authors present

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data showing that EUS-FNA not only aids in the identification of pancreatic cancers but also improves the management of patients by allowing for timely interventions based on accurate cytological findings.

Furthermore, the article discusses the challenges associated with EUS-FNA, including potential complications and the necessity for skilled practitioners to ensure optimal outcomes. The authors critically assess the limitations of EUS-FNA, such as the possibility of sampling errors or inadequate specimens, which can lead to misdiagnosis. This aspect is crucial for clinicians to consider, as it underscores the need for a thorough understanding of the technique and careful interpretation of cytological results.

The article titled "Endoscopic Ultrasound-Guided Fine Needle Aspiration Cytology of Pancreatic Adenocarcinomas Revisited. A Detailed Cytological Analysis" by (Kumar Mallik et al., 2021) contributes significantly to the understanding of fine needle aspiration (FNA) techniques specifically in the context of pancreatic adenocarcinomas. The authors emphasize the critical role of early detection in enhancing survival rates for patients diagnosed with this aggressive form of cancer.

The study highlights that endoscopic ultrasound-guided fine-needle aspiration cytology (EUS-FNAC) has become the preferred method for obtaining cytological samples from pancreatic lesions, particularly those that are not detectable through conventional imaging modalities. This advancement is crucial, as the ability to target smaller lesions can lead to earlier intervention, which is often associated with better prognoses.

One of the core challenges addressed in the article is the morphological variability of pancreatic adenocarcinomas. The authors detail the diverse cytological features that these tumors may exhibit, which can complicate accurate diagnosis via FNA. The presence of gastrointestinal contaminants is identified as a significant pitfall that can obscure the interpretation of cytological samples. This aspect underscores the necessity for cytopathologists to be well-versed in the distinctive characteristics of pancreatic adenocarcinomas and the common contaminants encountered in FNA samples.

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The analysis presented in the study is thorough, as it reviews 59 cases of pancreatic adenocarcinomas, providing a detailed cytomorphological assessment. This extensive examination not only reinforces the importance of EUS-FNAC in the diagnostic process but also serves as a reference for identifying potential diagnostic pitfalls. The findings suggest that while EUS-FNAC is a powerful tool, the variability in tumor morphology necessitates a careful, informed approach to interpretation.

The article titled "A Comparative Study of the Diagnostic Utility of Endoscopic Ultrasound-Guided Fine Needle Aspiration Cytology (EUS-FNA) versus Endoscopic Ultrasound-Guided Fine Needle Biopsy (EUS-FNB) in Pancreatic and Non-Pancreatic Lesions" by (Yousri et al., 2022) presents a thorough examination of the efficacy of EUS-FNA in diagnosing pancreatic lesions, particularly pancreatic cysts. The authors highlight the significance of EUS-FNA as a preferred method for obtaining tissue samples from gastrointestinal lesions, noting its diagnostic accuracy for pancreatic cancer, which ranges between 78% and 95%. This range is critical as it underscores the variability in diagnostic outcomes influenced by several factors.

The study emphasizes the importance of sensitivity and specificity in EUS-FNA, which are reported to be between 85% to 95% and 95% to 98%, respectively. The high specificity indicates that EUS-FNA is effective in correctly identifying patients without the disease, which is crucial for minimizing unnecessary interventions. However, the authors also point out that the diagnostic utility can be affected by lesion location, the experience of the endo-sonographer, and the type of needle used for aspiration. This multifactorial dependency suggests that while EUS-FNA is a powerful diagnostic tool, its effectiveness can vary significantly based on procedural variables.

One of the limitations of EUS-FNA highlighted in the article is its inability to provide core tissue samples that preserve the architectural integrity of the tissue. This limitation is particularly relevant for conditions such as lymphoma and autoimmune pancreatitis, where immunohistochemical staining is necessary for

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accurate diagnosis. To address this shortcoming, the authors discuss the development of core biopsy needles that can procure histological samples, thereby enhancing diagnostic capabilities.

Furthermore, the study aims to compare the diagnostic accuracy and technical success of standard 22-G FNA needles with FNB needles of different gauges in both pancreatic and non-pancreatic lesions. This comparison is particularly pertinent given the limited data available on the impact of needle type on diagnostic yield and technical success in the Egyptian patient population. The exploration of this comparison could provide valuable insights into optimizing diagnostic approaches for pancreatic cysts and other lesions.

The article titled "The value of concurrent endoscopic ultrasound-guided fine needle aspirates and needle core biopsies in the diagnosis of pancreatic neoplasms" by (M. Selvaggi, 2022) provides a comprehensive examination of the efficacy of endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) and needle core biopsies for diagnosing pancreatic lesions. The author emphasizes the safety, accuracy, and minimally invasive nature of EUS-FNA, highlighting its high sensitivity and specificity in detecting various pancreatic neoplasms, including pancreatic adenocarcinoma, neuroendocrine tumors, mucinous neoplasms, and intraductal papillary mucinous neoplasms.

One of the critical contributions of this study is the concurrent application of EUS-FNA and needle core biopsies, which significantly enhances the diagnostic yield. By performing these procedures simultaneously, clinicians are able to obtain a larger volume of tissue, which is crucial for comprehensive histological assessment and ancillary studies. The study indicates that both techniques exhibit similar sensitivity when nondiagnostic FNAs are factored into the analysis, which underscores the robustness of EUS-FNA in clinical practice.

Selvaggi ((M. Selvaggi, 2022)) further discusses the implications of rapid on-site evaluation (ROSE) during EUS-FNA procedures. This approach allows gastroenterologists to make immediate decisions regarding subsequent needle core biopsies in cases where initial FNA results are nondiagnostic. This adaptability in

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procedural strategy is significant, as it addresses potential sampling issues that can lead to discordant diagnoses. The high sensitivity and specificity reported for both EUS-FNA and needle core biopsies reinforce the reliability of these methods in clinical settings.

However, while the study presents compelling evidence supporting the concurrent use of EUS-FNA and needle core biopsies, it is essential to consider potential limitations. The reliance on sampling techniques may introduce variability in results, particularly in complex cases where the lesion characteristics can complicate the aspiration process. Additionally, the study primarily reflects outcomes from a single institution, which may limit the generalizability of the findings across diverse clinical environments.

CONCLUSION

The literature on fine needle aspiration (FNA) for pancreatic cysts and lesions has expanded significantly, demonstrating the critical role of this technique in diagnosing and managing pancreatic pathologies. The foundational work by (Kocjan, 2010) established FNA as a primary diagnostic tool, particularly emphasizing the need for cytopathologists to distinguish between mucinous and non-mucinous cysts, which has profound implications for patient management. The study highlighted the importance of endoscopic ultrasound (EUS)-guided FNA, which has become a standard procedure due to its accuracy in diagnosing and staging pancreatic malignancies.

Further studies, such as (Ramesh & Varadarajulu, 2012), reinforced the technical aspects of EUS-FNA, identifying procedural variables like needle gauge and the presence of an on-site cytopathologist as influential in achieving optimal diagnostic outcomes. The economic considerations of EUS-FNA were also discussed, suggesting a need for algorithmic approaches to enhance efficiency and reduce costs in clinical practice.

The analysis of pancreatic cyst fluid, as presented by (Alkaade et al., 2015), illustrated the incremental diagnostic yield of EUS-FNA over traditional imaging

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A systematic review by (S. Jani et al., 2016) synthesized various technical variables affecting EUS-FNA outcomes, reinforcing its adoption in clinical practice due to its minimally invasive nature and high diagnostic yield. The study by (Nigam et al., 2019) further emphasized the diagnostic efficacy of EUS-FNA, particularly in the context of pancreatic cancers, highlighting the necessity of timely intervention for improved therapeutic outcomes.

The complexities of diagnosing pancreatic adenocarcinomas via FNA were revisited in (Kumar Mallik et al., 2021), which detailed the morphological variability of these tumors and the potential for misdiagnosis due to contaminants. The comparative study by (Yousri et al., 2022) evaluated EUS-FNA against EUS-guided fine needle biopsy (EUS-FNB), suggesting that while both techniques are effective, EUS-FNB may provide advantages in obtaining adequate tissue for certain histological evaluations.

Lastly, (M. Selvaggi, 2022) demonstrated that combining EUS-FNA with needle core biopsies enhances diagnostic yield, providing sufficient material for ancillary tests. This integrated approach advocates for a more comprehensive methodology in clinical practice, thereby improving diagnostic accuracy and patient management.

In conclusion, the literature underscores the evolution of FNA cytology in diagnosing pancreatic cysts and lesions, highlighting its critical role in clinical decision-making. The advancements in procedural techniques, combined with a deeper understanding of diagnostic variables, have solidified EUS-FNA's place as a cornerstone in the management of pancreatic pathologies. Continued research and

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standardization in this field will further enhance the reliability and efficacy of this vital diagnostic tool.

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