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# Incidental brain MRI findings in intensive care unit patients: a retrospective analysis

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## ABSTRACT

**Aims:** Magnetic resonance imaging (MRI) frequently shows unexpected results unrelated to the presumed pathology. The aim of this study is to look into the frequency and type of incidental brain MRI findings in ICU patients.

**Methods:** The Anesthesiology and Reanimation Intensive Care Unit at Erzincan Mengücek Gazi Training and Research Hospital was the setting for the retrospective observational study. A total of 5,145 ICU patients admitted between 2021 and 2023 were screened using the hospital information management system, eliminating those without a brain MRI. Incidental findings in brain MRI data were documented and divided into five categories: vascular (aneurysms, cavernomas, and other vascular structures), neoplastic (meningioma, pituitary mass, glioma, and other tumors), Chiari malformation, pineal cyst, and arachnoid cyst.

**Results:** 1317 (25.6%) participants who received brain MRI were included in the study. Incidental MRI findings were detected in 366 patients (27.8%). The most common incidental discoveries were vascular anomalies (9.79%, primarily aneurysms and cavernomas), neoplastic lesions (8.81%, primarily meningiomas and pituitary masses), arachnoid cysts (2.89%), nonspecific plaques (2.81%), pineal cysts (2.66%), and Chiari malformations (0.84%). A large majority of these patients had clinically important findings that demanded additional clinical follow-up or evaluation; nevertheless, none required emergency surgical intervention. Patients with incidental findings had a mean age of 70.92±18.42 years (range 18-98).

**Conclusion:** In conclusion, incidental MRI results are common in critically ill patients and have significant clinical consequences. Enhanced clinician awareness and consistent management practices are critical for improving patient care, reducing unnecessary interventions, and optimizing results. Future prospective studies are required to create tailored guidelines for this population.

**Keywords:** Magnetic resonance imaging, incidental findings, critical care, brain diseases

## INTRODUCTION

Magnetic resonance imaging (MRI) is becoming more common in clinical practice as technology advances and is widely used due to its greater capacity to visualize anatomical structures and disease processes. This broad use has resulted in increasing discovery of incidental findings unrelated to the initially suspected disease or anomaly.[1,2] Incidental findings detected using MRI cover an extensive range of asymptomatic disorders, including neoplastic masses and vascular abnormalities such as arteriovenous malformations, aneurysms, and other less common vascular anomalies.[3,4] Previous research has found differing incidence rates of incidental observations in different populations, emphasizing their clinical significance. Specifically, incidental discoveries in MRI have been observed at rates between 2.7% and 18% in general populations, including healthy young adults, the elderly, and pediatric patients.[5-7] Despite the extensive literature on incidental MRI results, little is known about the occurrence, nature, and clinical importance of incidental brain MRI findings in critically ill patients admitted to intensive care units (ICUs). Addressing this gap is vital because critically ill patients frequently undergo MRI for a variety of therapeutic causes, which may result in the discovery of incidental diseases that affect clinical care. Clarifying the occurrence and clinical significance of these incidental discoveries might help enhance diagnostic strategies and clinical management protocols, ultimately improving patient outcomes in critical care settings.

The objectives of this study are to determine the frequency and nature of incidental MRI findings and to evaluate their clinical relevance in terms of management and prognosis in ICU patients. The study's findings are intended to give useful clinical insights, guide future clinical decision-making processes, and improve healthcare policies on the management of incidental MRI findings in critically ill populations.

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## METHODS

### Study Desing

This retrospective observational study was carried out at Erzincan Mengücek Gazi Training and Research Hospital's Anesthesiology and Reanimation Intensive Care Unit, in accordance with the STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) guidelines. The study was approved by the Erzincan Binali Yıldırım University Non-interventional Scientific Researches Ethics Committee (Date: 01.08.2024, Decision No: 2024-10/10). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. Since this was a retrospective study, routine general consent obtained from ICU patients upon hospital admission was used. All adult patients ages 18 to 100 who were admitted to the intensive care unit for any reason between January 2021 and December 2023 were included in the analysis. Patients who did not get a brain MRI scan for any reason were eliminated.

### Data Collection

The study included all patients with an anesthesia intensive care unit admission code recorded in the hospital information management system within the given dates. The faculty of our hospital's Department of Radiology examined and reported on MRI reports. Two radiologists with over ten years of experience independently reviewed the reports, and disagreements were resolved through consensus. Incidental findings in MRI reports were recorded and classified into five categories, as described by Sunny et al.,[4] vascular (aneurysm, cavernoma, other vascular lesions), neoplastic (meningioma, pituitary mass, glioma, other neoplastic masses), Chiari malformation, pineal cyst, and arachnoid cyst.

### Bias Reduction Measures

To reduce bias, all ICU patients who received MRI scans during the specified time frame were included. Furthermore, the study time was purposely extended to increase the number of patients and limit the possibility of bias.

### Statistical Analysis

Statistical analyses were carried out using IBM SPSS version 25.0 (SPSS Inc., Chicago, IL, USA). The normality of continuous data distribution was determined using the Shapiro-Wilk and Kolmogorov-Smirnov tests. Continuous data with normal distribution were summarized using mean±standard deviation (SD), while continuous variables with non-normal distribution were reported as median with minimum and maximum range. Categorical variables were summarized using frequency and percentages. The frequencies and percentages of incidental MRI findings were calculated, and the results were shown using bar graphs generated in Python using the Matplotlib tool. Since this was a retrospective study with a fixed sample size, no a priori power analysis was performed.

## RESULTS

This study involved a total of 5145 patients admitted to the Anesthesiology and Reanimation Intensive Care Unit between 2021 and 2023. 1317 patients had brain MRI scans. Among the patients who had MRI scans, 866 (65.8%) were men and 451 (34.2%) were women. The patients' mean age was 70.92±18.42 years (range 18-98 years).

Incidental findings were found in a variety of categories (**Table, Figure**). The most common incidental finding was classified as "other" vascular abnormalities (3.49%), followed by aneurysms (3.26%) and meningiomas (3.11%). Other common incidental findings included cavernomas (3.04%), arachnoid cysts (2.89%), nonspecific plaques (2.81%), pineal cysts (2.66%), pituitary masses (2.96%), gliomas (1.37%), and other neoplastic masses (1.37%). Chiari malformation was the least often observed incidental finding, appearing in only 0.84% of individuals. **Table** shows the detailed frequencies and percentages of incidental findings.

**Table. Frequency and percentage of incidental MRI findings**

| Incidental finding category | Number of patients | Percentage (%) |
|---|---|---|
| Other vascular anomalies | 46 | 3.49 |
| Aneurysm | 43 | 3.26 |
| Meningioma | 41 | 3.11 |
| Cavernoma | 40 | 3.04 |
| Pituitary mass | 39 | 3.96 |
| Arachnoid cyst | 38 | 2.89 |
| Nonspecific plaque | 37 | 2.81 |
| Pineal cyst | 35 | 2.66 |
| Glioma | 18 | 1.37 |
| Other neoplastic masses | 18 | 1.37 |
| Chiari malformation | 11 | 0.84 |

MRI: Magnetic resonance imaging

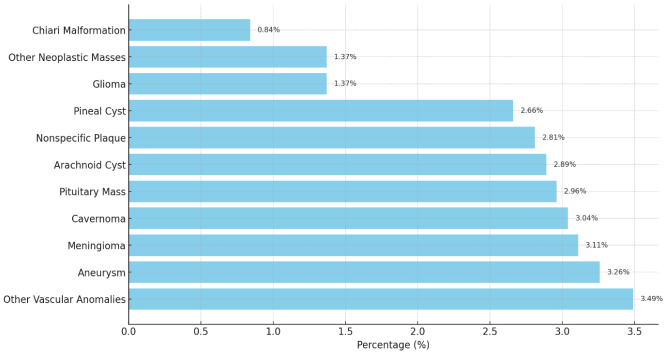


**Figure.** Bar graph showing the percentage distribution of incidental MRI findings

MRI: Magnetic resonance imaging

## DISCUSSION

This study demonstrated a considerable prevalence of incidental findings on brain MRI in critically ill ICU patients, providing valuable insights into an underrepresented population in the literature. Our findings are consistent with earlier research, indicating a high frequency of incidental finds across multiple populations, but with some variation in prevalence rates.

The finding that vascular anomalies, notably aneurysms and cavernomas, are among the most prevalent incidental findings supports previous research. Vernooij et al.[3] reported cerebral aneurysms as major incidental findings in the general population, underlining their clinical relevance and the potential for severe outcomes if undiagnosed or mistreated. Similarly, Weber and Knopf[1] highlighted vascular abnormalities as notable incidental discoveries among healthy

young males, demonstrating that these results are not isolated to the old or symptomatic populations.

Meningiomas and pituitary tumors were also common in the group we studied. Previous investigations back up these findings, establishing meningiomas as prevalent benign brain tumors typically met incidentally in elderly persons.[2,5] Pineal and arachnoid cysts, which we discovered at rather high frequency, have repeatedly been reported as common incidental findings across diverse age groups.[7,8]

The relatively high prevalence of nonspecific white matter lesions or plaques observed in our study echoes findings from broad population-based studies, indicating an increasing trend in incidental detection of these lesions, possibly associated with vascular risk factors prevalent in ICU populations.[9,10]

In contrast to our findings, pediatric studies, such as Dangouloff-Ros et al.,[6] show that incidental findings in young people typically differ in prevalence and clinical significance compared to adult populations, with intracranial cysts and developmental anomalies like Chiari malformations being more common. These discrepancies highlight the importance of age-appropriate interpretation and management recommendations. Additional investigations reinforce the clinical importance of incidental MRI findings across diverse demographics, emphasizing their potential impact on healthcare management, costs, and other consequences.[11-13]

Our study showed a higher rate (27.8%) of incidental findings compared to previous studies (2.7%-18%). This may be since of the older average age, expanded predominance of comorbidities, and basic ailment status of ICU patients, which may incline them to such discoveries.

This study focuses on incidental MRI findings in critically ill ICU patients, a cohort that has not been substantially explored previously. ICU patients may have many concomitant diseases, complicating the management of incidental findings. Such findings may have an impact on treatment decisions, length of hospital stay, and prognosis. As a result, developing a defined management approach for incidental findings in critically ill patients is vital.

### Limitations

The limitations of this investigation must be noted. Its retrospective, single-center approach may induce selection bias and reduce generalizability. The lack of prospective data gathering could have resulted in missing or incomplete information. Furthermore, even when experienced radiologists are involved, inconsistency in MRI interpretation may influence outcomes. As a result, our findings should be taken with caution when applied to other patient demographics or therapeutic contexts.

Nevertheless, our study offers some advantages. It comprises a high number of severely ill ICU patients, which improves the accuracy of prevalence estimations. Furthermore, all MRI evaluations were consistently done by highly experienced radiologists, resulting in good diagnostic accuracy and little inter-observer variability. Furthermore, the broad inclusion criteria, which included all adult ICU patients having MRI, increased the representativeness of our findings.

Our findings have substantial therapeutic implications for the management of ICU patients, emphasising the importance of structured follow-up and treatment plans for incidental findings. Future research should concentrate on prospective, multicenter studies to properly control for potential biases and validate these findings across multiple therapeutic settings. Additional research could look into the effects of certain incidental findings on long-term patient outcomes and healthcare resource consumption.

Due to the retrospective nature of this investigation and the limitations of the available data, no subgroup analyses were undertaken. Future prospective studies could look into specific subgroups based on demographic or clinical variables to provide more precise insights.

## CONCLUSION

As a result, incidental MRI findings among intensive care unit patients are frequent and significant from a clinical standpoint. Patient outcomes may be enhanced by acknowledging and appropriately managing these results. Prospective investigations and the creation of uniform techniques are required.

## ETHICAL DECLARATIONS

### Ethics Committee Approval

The study was carried out with the permission of the Erzincan Binali Yıldırım University Non-interventional Scientific Researches Ethics Committee (Date: 01.08.2024, Decision No: 2024-10/10).

### Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

### Referee Evaluation Process

Externally peer-reviewed.

### Conflict of Interest Statement

The authors have no conflicts of interest to declare.

### Financial Disclosure

The authors declared that this study has received no financial support.

### Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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