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RESEARCH ARTICLE

IS TEACHING BY RESIDENTS COMPARABLE TO THAT OF FACULTY IN TERMS OF KNOWLEDGE, SKILLS, AND ATTITUDES? A CASE STUDY USING TRANSCRANIAL DOPPLER TRAINING

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Abstract

Background: A significant portion of clinical supervision is provided by residents, who typically lack formal pedagogical training but noneth eless assume teaching responsibilities.
Objective: To assess a resident-led supervision model compared to traditional faculty-led teaching across three domains: knowledge, skills, and professional attitudes.
Methods: We conducted a one-month, single-center interventional study involving six medical interns. Following a theoretical session, they were randomized into two groups: one supervised by a faculty member, and the other by a senior resident. Both groups received a practical training session, with teaching methods left to the discretion of each instructor. Participants were then required to perform seven transcranial Doppler ultrasound examinations. Outcomes in knowledge, skills, and behavior were compared between groups. Data were analyze d using Jamovi software (version 2.3.21) with Student's t-test and chi-square test. Statistical significance was set at $p \leq 0.05$.
Results: A total of 41 logbooks were analyzed. A significant difference was observed in the 'skills' domain, while no statistically significant differences were noted in the 'knowledge' or 'attitudes' domains.
Conclusion: Senior residents serve as role models for junior doctors. Incorporating pedagogical training into their curriculum may enhance their teaching competencies.

Introduction:-

Peer teaching is increasingly prevalent in universities, particularly in medical schools. Residents play a pivotal role in the education of junior learners, including medical externs, interns, and even younger residents. It has been reported that residents spend approximately 20% of their time teaching and are responsible for up to 80% of the clinical training of medical students and interns.

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Given the growing number of medical students, peer teaching represents a viable solution to the shortage of faculty and benefits both learners and resident-teachers.Transcranial Doppler (TCD) ultrasound is a non-invasive tool that enables real-time evaluation of cerebral hemodynamics. It can identify life-threatening conditions that require immediate intervention, sometimes even before a brain CT scan is performed.Faced with the overcrowding of medical schools and a declining faculty-to-student ratio, we sought to evaluate a resident-led teaching model versus one led by faculty across three educational domains—knowledge, skills, and professional behavior—using TCD training in an ICU setting as a test case.

Materials and Methods:-

We conducted a one-month interventional study in the general ICU of the 20 Août 1953 Hospital at CHU Ibn Rochd, Casablanca. We included six junior interns (in general medicine training who had not yet defended their thesis) with no prior TCD training. This was explicitly confirmed by each participant. They first received a theoretical session using a standardized written handout developed within the department. The handout included clinical indications for TCD in the ICU, anatomical review of the circle of Willis, the Aaslid technique, and how to identify landmarks using 2D and color Doppler modes.

Participants were then randomized into two groups of three. Each group received a practical session on the same day, in two separate rooms and during the same time slot. Group 1 was supervised by a faculty member trained in pedagogy and expert in TCD, while Group 2 was supervised by a senior resident in the final year of anesthesia and intensive care training. Both instructors were technically proficient in TCD, having received specific training in transcranial Doppler.The instructional approach during the hands-on session was left to each supervisor's discretion. Objectives of the session included performing TCD on healthy volunteers, answering questions, correcting probe handling, locating the temporal window and cerebral peduncles, identifying the middle cerebral artery (MCA), obtaining velocity measurements with quality signals, interpreting results, and determining appropriate management decisions.

Participants were instructed not to share their learning experiences with members of the other group. One week later, each participant was asked to perform seven TCD exams on ICU patients included in the study. Eligible patients were adults (≥18 years) admitted during the study period who had previously undergone at least one successful TCD confirming a viable acoustic window. A maximum of two exams per patient per day was allowed. Patients were excluded if they declined the exam or had cerebral pathologies such as meningoencephalitis or vasculitis.Each participant documented exam findings, interpretation, and proposed management in individual logbooks. A TCD-experienced observer timed the procedure without intervening; he was blinded to the participants' group allocation.Three time points were recorded: T1 – from probe placement to identification of cerebral peduncles; T2 – from cerebral peduncles to MCA identification; T3 – from MCA visualization to acquisition of pulsatility index (PI), systolic velocity (SV), and diastolic velocity (DV).

Assessment criteria included:

- **Skills:** measured by T1, T2, and T3 durations, failure rate (no results within 10 minutes), and agreement with expert reference values (defined as results that did not change clinical decisions).
- **Knowledge:** interpretation accuracy based on age-adjusted Doppler values and consistency with expert management plans.
- **Professional behavior:** whether participants introduced themselves to the patient, explained the procedure, and cleaned the probe afterward.

Data were analyzed using Jamovi version 2.3.21. Quantitative variables were reported as medians and interquartile ranges (IQR), while qualitative data were presented as counts and percentages. Group comparisons were made using Student's t-test for normally distributed variables, Mann-Whitney U test for non-normal distributions (assessed by Shapiro-Wilk), and chi-square or Fisher's exact test for qualitative variables as appropriate. A p-value ≤ 0.05 was considered statistically significant.

Results:-

A total of 42 logbooks were collected. One was excluded due to missing data. Group 1 (faculty-supervised) had 20 logbooks, and Group 2 (resident-supervised) had 21.Patient age ranged from 18 to 85 years. In Group 1, 30.4% of patients were under 45, compared to 69.9% in Group 2. Median diastolic velocity (DV) was 22.7 cm/s [IQR: 20.4–25.1] in Group 1 versus 35 cm/s [IQR: 25–44] in Group 2. Median systolic velocity (SV) was 65.8 cm/s [IQR: 53.3–74] in Group 1 versus 80 cm/s [IQR: 68–85] in Group 2. Median pulsatility index (PI) was 1.18 [IQR: 0.92–1.46] in Group 1 versus 1.00 [IQR: 0.90–1.15] in Group 2. In univariate analysis, Group 1 showed significantly shorter times from cerebral peduncles to MCA identification (T2, $p < 0.001$) and from MCA identification to PI/SV/DV acquisition (T3, $p = 0.006$). No statistically significant differences were found for other parameters. Detailed comparisons are provided in Table I.

Discussion:-

This study compared learner performance based on whether they were trained by a faculty member with pedagogical training or a senior resident without such training. While both trainers had equivalent clinical expertise, the faculty member had the advantage of pedagogical preparation. Residents are essential to clinical education in medical schools, especially in contexts of student overpopulation and limited teaching staff. Since the 1970s, the concept of the 'resident-as-teacher' has been widely discussed in the literature. Residents are dual affiliates—both caregivers and academic contributors—positioning them as natural educators for younger trainees. Studies suggest that residents spend 20–32% of their time teaching, juggling academic duties, clinical responsibilities, and personal lives. They teach peers, interns, nurses, and junior residents, making them integral to the educational ecosystem. Residents act as role models, consciously or unconsciously influencing junior learners. This influence may be beneficial or detrimental depending on the resident's own training. Our findings suggest that pedagogical training could enhance the educational effectiveness of senior residents.

In the 'professional behavior' domain, both groups performed similarly—likely because senior residents feel responsible for setting a good example, especially if they themselves have received effective behavioral modeling during training. In the 'knowledge' domain, the faculty-led group showed better concordance in interpretation and clinical decisions, although differences were not statistically significant. This may reflect the resident's routine role in educating interns, supported by findings from other studies. In the 'skills' domain, the faculty-led group outperformed the resident-led group, with statistically significant differences in T2 and T3 times. There was also a higher failure rate in the resident group, although this was not statistically significant. These disparities suggest that pedagogical methods may improve procedural training effectiveness. Thus, effective teaching in medicine requires dual expertise—clinical and pedagogical. Integrating educational training into residency programs could optimize resident-led instruction. Such interventions need not follow a single format; rather, familiarity with educational tools and their thoughtful application is key. In their study, Sánchez et al. found that although residents felt competent to teach, they also expressed a strong need for formal teaching skills development. In an era emphasizing learner-centered education, it is essential to consider the needs of resident educators and provide targeted pedagogical training. These initiatives must also take into account time constraints and clinical workload, which often hinder teaching efforts.

This study has several limitations that should be acknowledged. First, the small sample size (six participants and 41 completed logbooks) limits the statistical power and generalizability of the findings. The study should be considered exploratory in nature, and its results interpreted with caution. Second, although the trainers in both groups had comparable clinical expertise, their teaching styles and approaches were not standardized, introducing potential variability in instructional quality. This lack of control over the pedagogical method may have influenced learner outcomes independently of the trainer's status as faculty or resident. Third, the evaluation of 'soft skills' was based on simple criteria which may not fully capture the complexity of professional attitudes and communication skills in clinical settings. Lastly, the concordance with expert interpretation and decision-making, used as a proxy for knowledge assessment, lacked formal inter-rater reliability analysis. Future studies should incorporate standardized assessment tools to enhance objectivity.

Conclusion:-

Residents play a crucial role in the training of medical students and act as role models. This role should be reinforced through the integration of pedagogical training into residency programs. Such training could awaken academic vocations in some residents, enhance their own learning through teaching, and ensure more effective

guidance for junior learners. With such interventions, the differences in performance observed in this study could be minimized, ensuring high-quality education regardless of whether learners are supervised by faculty or residents.
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