



Forensic age assessments of alleged unaccompanied minors at the Medicolegal Institute of Montpellier: a 4-year retrospective study

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Abstract

Background As many other European countries, France has to deal with a growing number of migrants including some who contend age minority entitling them to benefits and privileges reserved for children within the context of legal proceedings. In case of doubtful minority, medical examinations may be carried out to assess skeletal and dental age. Our objective was to analyse the age assessments regarding individuals of doubtful minority assertion at the Medico-legal Institute of the University Hospital of Montpellier since 2018.

Methods Expert reports of forensic age assessments performed during the 2018–2021 period were reviewed. Demographic data and results from medical and radiological investigations based on AGFAD recommendations were recorded in each case. When available, conclusions of judicial investigations about the individuals' actual age were collected.

Results A total of 265 reports were compiled. Age assessments predominantly concerned males (97.7%) and the main reported country of origin was sub-Saharan Africa (80.4%). The mean reported age was 16.3 ± 0.8 years. The individual's stated age was compatible with the age assessment in 31 cases (11.7%), while expert reports concluded that the age of majority had been reached in 131 cases (49.4%). In cases of discrepancies, the average difference between the stated and the assessed lowest possible age (= assessed minimum age) was 2.7 ± 2.3 years and 6.9 ± 3.8 years between the stated and the most probable age. Age assessments could be compared with actual ages determined by court proceedings in 27 cases, with established ages being systematically higher than the assessed minimum ages (mean difference = 4.4 ± 4.0 years). The difference between actual and stated ages ranged from 1.8 up to 18.9 years (mean difference = 6.4 ± 4.0 years). The used protocol never led to any age overestimation in this population.

Conclusion Our study reinforces the relevance of AGFAD recommendations for forensic age assessment and calls for the harmonization of practices based on this methodology in the European countries.

Keywords Age assessment · AGFAD recommendations · Unaccompanied minors · Age of majority · Forensic medicine

Introduction

In the last decades, an increase of cross-border migration has been noted in EU-Member States. From 2016 to 2020, a total of 3.7 million of asylum applications were lodged including

515,360 in France, making France the second country in terms of applicants registered after Germany [1, 2].

These high migration inflows have resulted in a growing number of refugees without reliable identity documents who pretend to be minors. Unaccompanied third-country children are entitled to particular privileges, such as protection against deportation or youth welfare services [3].

Medical age assessment of living individuals has therefore significantly gained importance in forensic practice in many European countries, and hence requires reliable methods. In this regard, recommendations have been developed by the interdisciplinary German “Study Group on Forensic Age Diagnostics” (AGFAD) in order to standardize the

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assessment procedure and to implement quality assurance in this area [4].

In France, where the age threshold of legal relevance is 18 completed years, alleged unaccompanied minors are first subject to a qualified inspection by youth welfare offices to confirm their age minority [2, 5]. In cases of serious doubts towards stated age minority, a forensic examination must be carried out by court order as part of the evaluation of the person's age [6].

At the Medico-legal Institute of Montpellier, forensic age assessment of living persons strictly follows AGFAD recommendations since 2018. The present paper summarizes the outcome of such standardized age assessments carried out in young refugees of doubtful minority in our institute since these guidelines have been implemented.

Material and methods

Expert reports of forensic age assessments performed at the Medico-legal Institute of the University Hospital of Montpellier from January 1, 2018 to December 31, 2021 were retrospectively reviewed. For all persons examined, demographic data including sex, alleged date of birth and country of origin were recorded as well as results of medical and radiological investigations as recommended by AGFAD.

The AGFAD three-step procedure [4, 7, 8] includes a thorough anamnesis and a physical and dental examination by a medical practitioner to exclude age-relevant developmental disorders and medication possibly interfering with skeletal development. An X-ray examination of the left hand and an orthopantomogram were then performed. In case of a complete development of the hand skeleton, an additional CT scan of the clavicular sternal ends was carried out. All CT examinations were performed using a General Electric 750 HD Discovery® (multi-slice spiral CT; rotation time = 1 s, tube voltage = 120 kV, effective mAs = 200, pitch = 0.5, collimation = 20 mm, matrix = 512 × 512, scan length (z-axis resolution) = 4 cm, slice thickness = 0.6 mm). The CT images were evaluated using a commercially available workstation with General Electric software (Advantage Window). Axial views of the medial clavicular endings were obtained as well as multiplanar frontal reconstructions (MPR technique).

The development of the hand skeleton was assessed based on the Greulich and Pyle atlas [9], the dental status based on Demirjian's stages [10] and the radiographic examination of the clavicles according to stage classifications by Schmeling et al. and Kellinghaus et al. [11–13].

All images were reviewed by experienced dentists and radiologists following a double-blind evaluation process. In case of discrepancy, a consensus was found with the forensic

expert. CT scans displaying bilateral anatomical shape variations were not interpreted.

The most probable age of the individuals was determined based on the corresponding reference study [11–21] when at least one of the developmental systems was incompletely matured. The minimum age was determined according to the highest minimum age among those provided by the reference studies used for the assessment of each developmental system. The differences between the minimum age and the stated age at the time of the examination and between the most probable age and the stated age were calculated.

When available, conclusions of judicial investigations related to the determination of the actual age of the individuals examined in our institute were collected, in order to verify our assessment results. The correlation between the actual and the most probable age was calculated using Spearman's coefficient.

Results

A total of 265 expert reports were included. The annual number of forensic age assessments ranged from 48 (in 2020) to 81 (in 2019) (Fig. 1), with the vast majority (approximately 80%) being carried out in the context of criminal proceedings. Main accusations were fraud and forgery of administrative documents, followed by theft, robbery, physical assault and possession of narcotics. The remaining 20% of age assessments was performed on behalf of youth welfare offices as part of the evaluation of the person's minority.

Of the persons examined, 259 were male and only 6 were female. A substantial part of them originated from sub-Saharan Africa (80.4%), followed by North Africa (9.8%) and South Asia (9.1%) (Fig. 2). All individuals stated an age between 13.3 and 17.9 years (Fig. 3), with a mean reported age of 16.3 ± 0.8 years.

Two hundred fifty-nine out of 265 individuals presented a completely ossified forearm and hand skeleton and six cases an incomplete ossification (five cases with a skeletal development corresponding to the "Male standard 30 18 years" according to the Greulich and Pyle atlas, and one case to the "Male standard 29 17 years").

Eighty-nine per cent ($n = 218$) of the assessable orthopantomograms ($n = 246$) revealed a stage H of root mineralisation of mandibular third molars on at least one side. Third molars were missing bilaterally, or their roots could not be assessed (due to abnormal tooth implantation or poor X-ray quality) in 19 cases (7.2%). Regarding the radiographic examination of the medial clavicular endings, 27.4% ($n = 69$) of the assessable CT scans ($n = 252$) showed a stage 3c on at least one side, while 20.6% ($n = 52$) showed a stage 4 and 4.0% ($n = 10$) a stage 5. Seven CT scans could not be interpreted because of bilateral anatomical shape variations.

Fig. 1 Number of forensic age assessments performed at the Medico-legal Institute of Montpellier from 2018 to 2021, in comparison with the annual number of applications processed by French youth welfare offices

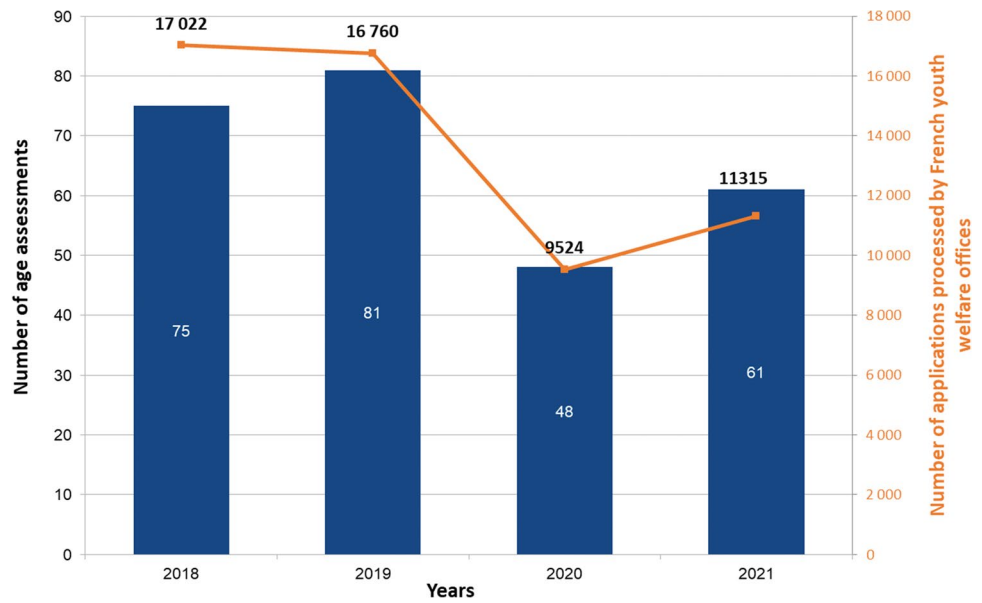
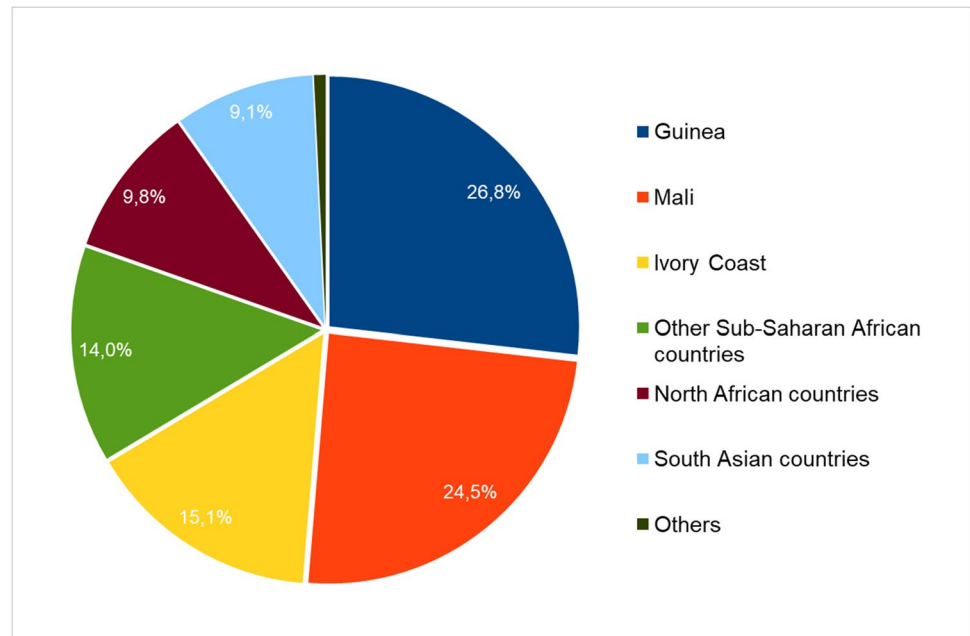


Fig. 2 Reported countries of origin of the alleged unaccompanied minors



The individual’s stated age was compatible with the assessed minimum age in 31 cases (11.7%). In the remaining cases ($n = 234$), the stated age was below the assessed minimum age, with an average difference of 2.7 ± 2.3 years (Fig. 4). A most probable age could be determined in 217 of these cases because of an incomplete skeletal and/or dental development. The average difference between the stated and the most probable age was 6.9 ± 3.8 years (Fig. 5).

Overall, the forensic age assessment concluded that the examined persons had reached the age of majority beyond reasonable doubt in 131 cases (49.4%), while 123 cases (46.4%) had most probably crossed this age limit. In other

words, in 95.85% of the cases, age majority was reached either unequivocally or most probably.

In cases where it was possible to verify our age assessments, i.e. where the individual’s actual age could have finally been established by court proceedings ($n = 27$, 10.2%), the difference between the actual and the stated age ranged from 1.8 to 18.9 years (mean = 6.4 ± 4.0 years). The established age was systematically higher than the assessed minimum age with a mean difference of 4.4 ± 4.0 years, while the average difference between the established and the most probable age was -0.6 ± 4.7 years

Fig. 3 Stated ages of the alleged unaccompanied minors

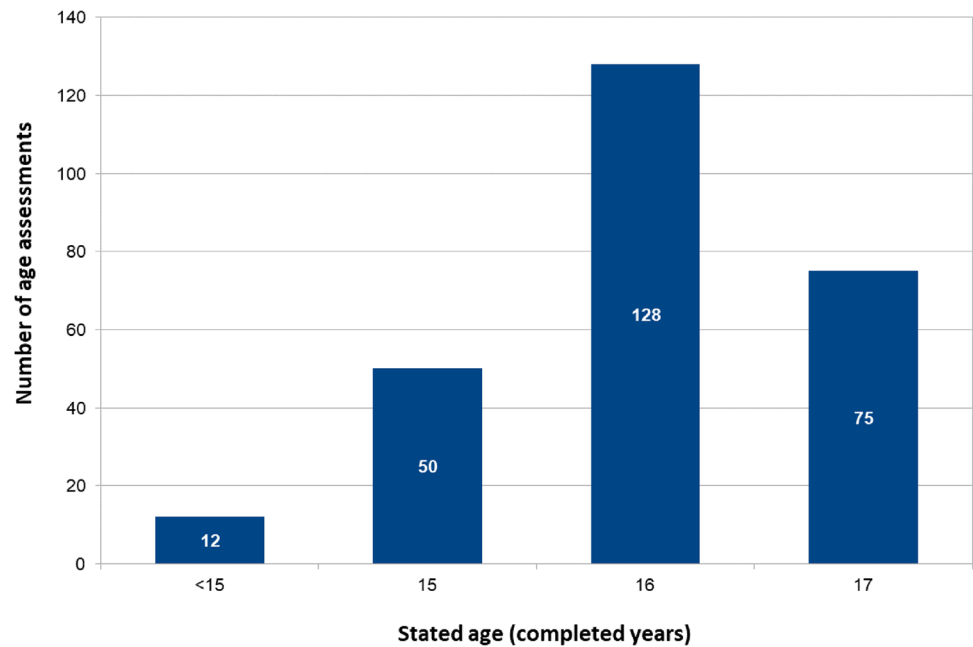
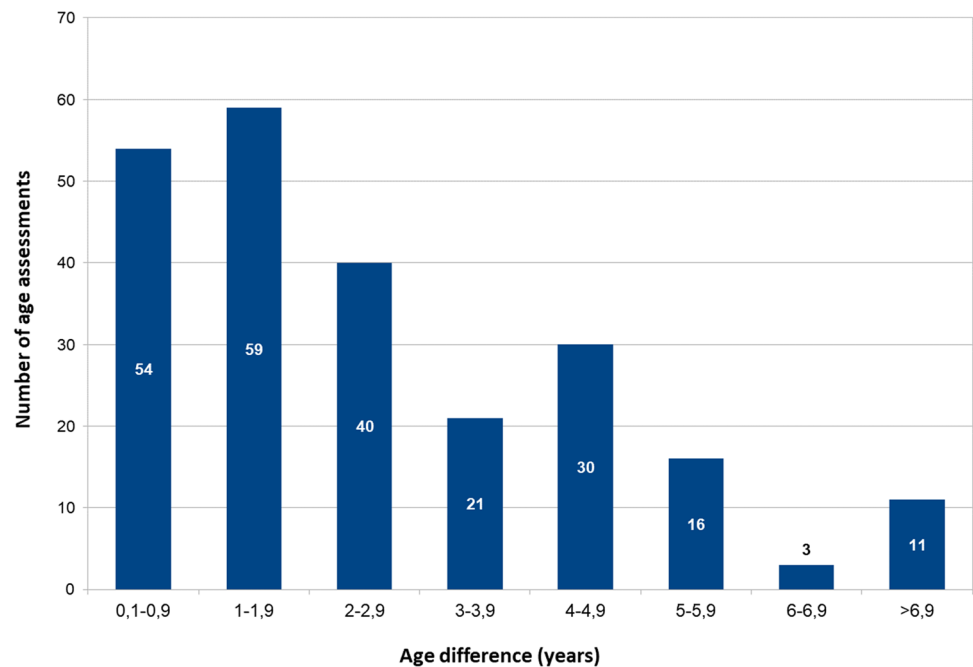


Fig. 4 Differences between the stated age and the minimum estimated age in cases where the stated age was not compatible with the forensic age assessment ($n = 234$)



(Fig. 6). No correlation could be found between the established and the most probable age ($r = 0.13$, $p = 0.53$).

Discussion

Between 2018 and 2021, 265 age-disputed refugees were examined at the Medico-legal Institute of Montpellier in order to assess their age according to AGFAD recommendations. This represents 7.6% of forensic age assessments

carried out by court order in France during the same period [22]. However, this percentage is significantly higher when only considering age assessments carried out according to AGFAD recommendations. Indeed, only 12 out of the 35 Medico-legal Institutes performing age assessments in France (34.3%) include an X-ray examination of the hand skeleton, an orthopantomogram and a CT examination of the clavicles as part of their assessment protocol [23]. Other institutes perform a radiographic examination of the hand skeleton whether alone ($n = 5$, 14.3%) or in association with

Fig. 5 Differences between the stated age and the most probable age in cases where the stated age was not compatible with the forensic age assessment and where at least one developmental system was not completely matured ($n = 217$)

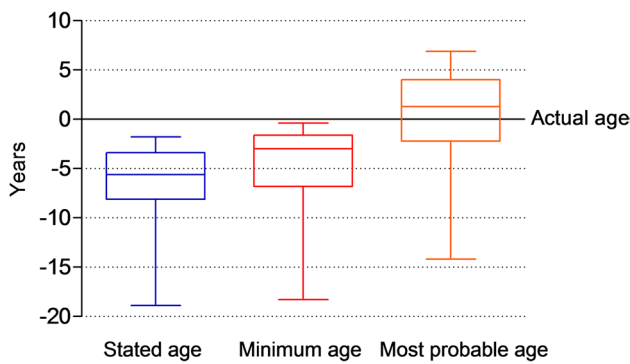
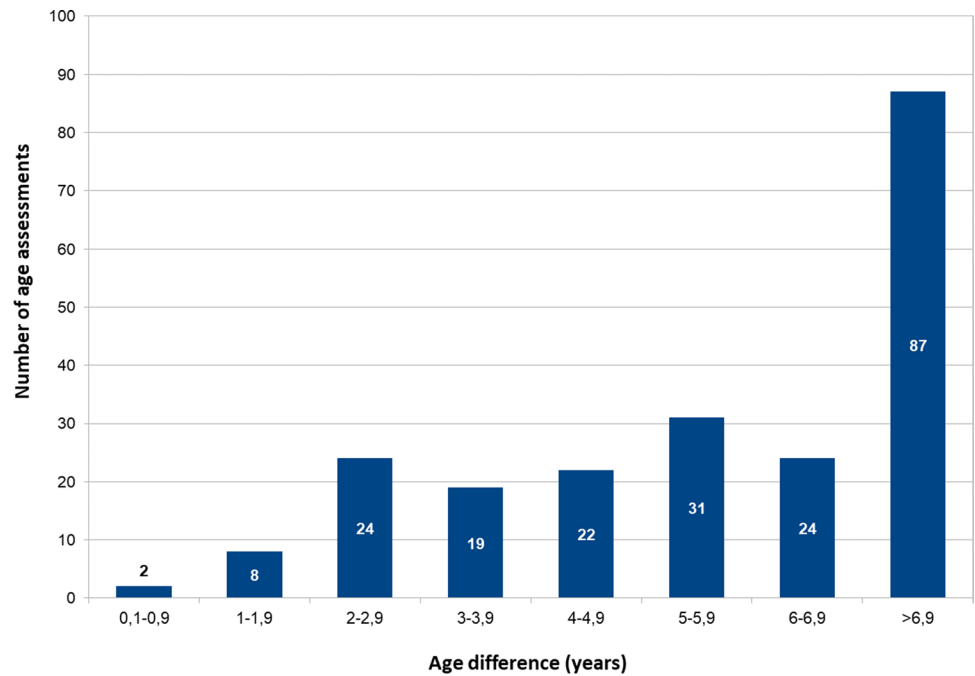


Fig. 6 Box plot diagrams displaying the differences in years between the actual age and the stated, minimum and most probable ages in cases where the actual age could be determined in the course of legal proceedings ($n = 27$). The outlines of the boxes indicate the 25% and 75% percentiles and the solid line inside the boxes the median. End of lines show the minima and maxima

either an orthopantomogram ($n = 12$, 34.3%) or a CT examination of the clavicles ($n = 6$, 17.1%). Our institute actually carried out more than 20% of the standardized examinations based on AGFAD recommendations performed at the national level in 2021 [22].

In comparison, 54,621 requests from unaccompanied minors were processed by French youth welfare offices between 2018 and 2021 [24] (Fig. 1). However, the number of applications lodged by unaccompanied minors in 2020 and 2021 significantly decreased in European countries including France [1, 2, 24, 25] mainly due to the COVID-19 pandemic and the related travel restrictions implemented

by the EU Member States. As a result, the number of age assessments during these 2 years was proportionally reduced compared with 2019 at the national level (respectively – 51% and – 45%) [25] and at our institute (respectively – 41% and – 25%).

The vast majority (97.7%) of unaccompanied minors examined in our institute during the 2018–2021 period were male and originated from countries of sub-Saharan Africa, mainly Guinea (26.8%), Mali (24.5%) and Ivory Coast (15.1%). This is consistent with national figures regarding unaccompanied minor applications and age assessments which showed a clear predominance of male refugees (95%) from these three countries [22, 25]. A recent German study also found that most unaccompanied minors examined in Münster during the 2017–2018 period came from countries of sub-Saharan Africa, with Guinea being the most represented country (31%) [3]. As regards the declared ages, our figures also complied with national statistics, with a predominance of individuals stating an age of 16 years and over (76.6%) in our study. This age group accounted for 64.5% of applicants in France during the 2018–2020 period [25].

All but a few of the individuals had a completed development of the forearm/hand skeleton (97.7%), which allowed the implementation of the full AGFAD procedure including a CT scan of the clavicular sternal ends in most cases. A negligible part of orthopantomograms and CT scans could not be interpreted, mainly because of missing teeth or anatomical variations ($n = 19$ and $n = 7$, respectively).

One hundred thirty-one of the assessable CT scans showed a stage 3c or a more advanced stage. The most prevalent stages of clavicular ossification were 3c (27.4%)

and 4 (20.6%), while stage 5 accounted for 4.0%. Overall, 131 unaccompanied minors (49.4%) were thus considered to be 18 years or older beyond reasonable doubt. In the remaining cases where minority could not be excluded by forensic assessment (although the age of majority had probably been reached for most of them), the individual's claimed age was compatible with the forensic expert's age assessment in 31 cases (11.7%).

Numerous studies on forensic age assessment of migrants have been carried out in various countries [3, 26–32]. Among those that applied AGFAD recommendations, Hagen et al. reported 37.8% of unaccompanied minors that had reached the age of majority beyond doubt [3], while Rudolf et al. found that 61% had reached this age limit in their cohort [26].

In order to validate the age assessments performed in our institute, we compared our age diagnoses with the ages established in the course of legal proceedings. The sources of verification included identification documents (birth certificates, passports), rectified information on their age given by the persons during the proceedings and tapping of phone lines. Actual ages could be established in only 27 cases, highlighting the duration and the low completion rate of these proceedings (some of them were still ongoing at the time of writing this article). This is partly due to the frequent lack of reliable birth registration systems in the countries of origin [3, 26]. However, it could be observed from this subsample that the assessed minimum age was systematically lower than the established age, which was always beyond the age of majority. In other terms, the protocol used never led to any age overestimation. The mean difference between the claimed and the verified age was 6.4 ± 4.0 years, while the most probable age tended to be higher than the verified age. However, it should be kept in mind that the determination of the individual's age in the course of legal proceedings is sometimes based on identification documents potentially containing false information that rejuvenate the persons while still considering them 18 years or older. By consequence, the age differences observed could have been underestimated, and any correlation between the actual and most probable age could have been prevented. Once again, a comparison with data from other studies is difficult given the fact that the protocol used for age assessment in these studies did not match with AGFAD recommendations, except in the study of Schmeling et al. [28] in which deviations between the estimated and the actual age did not exceed ± 12 months in cases where the age of the person could be verified, thus demonstrating the reliability of the three-step procedure.

In conclusion, our study reaffirms the value of AGFAD guidelines for forensic age assessment of living adolescents and young adults. This scientific approach currently represents the most reliable methodology and should therefore be systematically applied for assessing the skeletal and dental

age of young refugees with questionable minority. We stress the need for European countries to standardize their practice of age assessments based on the AGFAD methodology.

Declarations

Research involving human participants This retrospective chart review study involving human participants was in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All the procedures performed were part of the routine practice.

Informed consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare no competing interests.

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