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Identifying the Primary Crime Scene Location Through Plant-Based Evidence: A Case Study

تحديد الموقع الرئيسي لمسرح الجريمة من خلال الأدلة النباتية: دراسة حالة

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Abstract

Forensic botany is a scientific investigation methodology that deals with the analysis of plant based evidence for solving crimes. The correlation of plants as the basis of life is supplemented by their extensive ability to seek justice for the dead and wronged through this domain. The ubiquity of botanical matter results in its presence in virtually all outdoor crime scenes. In such a scenario, these evidences can provide valuable insights into the place and manner of occurrence of the crime, among others. This case report presents one such instance of homicide, demonstrating the prowess of botanical evidence in establishing the place of discovery of the body as the primary crime scene. This was achieved through the comparison of grass at the intended site with control samples to ascertain factors such as morphology, compression and traces of blood. The breakthrough came with the analysis of the victim's hair strands entwined with grass fibres, severed through the application of sharp trauma rather than decomposition. Thus the study of botanical evidence was able to rule out possibilities of attack occurring elsewhere and attest to the site of discovery of the body as the scene of the fatality.

Keywords: forensic sciences, forensic botany, morphology, primary crime scene location

المستخلص

علم النبات الجنائي هو منهجية تحقيق علمي تتعامل مع تحليل الأدلة النباتية لحل الجرائم. كما أن العلاقة بين النباتات كأساس للحياة تُستكمل بقدرتها الواسعة على تحقيق العدالة للأموات والمظلومين من خلال هذا المجال. ويؤدي الانتشار الواسع للمواد النباتية إلى وجودها في جميع مسارح الجرائم الخارجية تقريباً.

في مثل هذا السيناريو، يمكن لهذه الأدلة أن تقدم رؤى قيمة حول مكان وطريقة وقوع الجريمة، من بين أمور أخرى. يقدم تقرير الحالة هذا مثالاً واحداً على جريمة قتل، يوضح براعة الأدلة النباتية في إثبات أن مكان اكتشاف الجثة هو الموقع الرئيسي لمسرح الجريمة.

تم تحقيق ذلك من خلال مقارنة العشب في الموقع المقصود بعينات مرجعية للتأكد من عوامل مثل الشكل الظاهري (المورفولوجيا)، الانضغاط، وآثار الدم. جاء الإنجاز بتحليل خصلات شعر الضحية المتشابكة مع ألياف العشب، والتي قُطعت من خلال تطبيق صدمة حادة بدلاً من التحلل. وبالتالي، تمكنت دراسة الأدلة النباتية من استبعاد احتمالات وقوع الهجوم في مكان آخر وتأكيد أن موقع اكتشاف الجثة هو مسرح الوفاة.

الكلمات المفتاحية: علوم الأدلة الجنائية، علم النبات الجنائي، الشكل الظاهري (المورفولوجيا)، الموقع الرئيسي لمسرح الجريمة.

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1. Introduction

Forensic botany is a branch of forensic science which is concerned with use of plants for solving crimes. Plants are ubiquitously distributed in nature. Thus, plant based evidences can play an important role in the justice delivery system. Although this largely remained as an underdeveloped field during the previous century, presently, many cases have been solved using botanical evidences. As plant materials are widely distributed they can be used to determine and analyse crime scene locations, link the crime scene with victim and/or suspect, connect the murder weapon to the crime and suspects etc. Grasses are amongst the most commonly encountered plant material in a crime scene and have the potential to provide vital information [1]. The present paper deals with a case in which analysis of grass helps to establish the primary crime scene, a crucial endeavour, since the evidences collected from such a location can help in the investigation process by linking the crime to the victim and suspect and may be helpful in conviction of the perpetrator.

2. Case Presentation

When a local resident discovered the dead body of a middle aged women lying in a grazing field on the border of a small village in the concerned district of our state, he informed the village chief about it promptly. The chief rushed to the spot and the information was passed on to the villagers which made Ms. Y and few others visit the field. The onlookers recognized the dead person as Ms. X, the middle sister of Ms. Y who went missing five days ago. The police were informed about the discovery of the dead body and after reaching the field they started their investigation process.

The area where the dead body of Ms. X was found had a few bushes and was surrounded by small thorny plants in the north, east and west directions and by mountains in the south direction. The police marked an area of approximately 10 feet in length and 5 feet in width and classified it as the place of discovery of the dead body. It was observed that the entire area within the place of discovery of the body and outside was covered by grasses. Approximately at a distance of 2 feet outside the place of discovery a neem tree was also present.

The covered dead body was highly decomposed and infested with blow flies approximately 0.5 to 1 cm in length (as reported by the forensic pathologist later) and decomposed liquid was oozing out. The head of the dead body was found to face the east direction and the legs were facing the west direction. Many body parts of the deceased were also found missing. The dead body was sent for post mortem.

Meanwhile the investigation officer in the presence of forensic mobile officer of the Directorate of Forensic Science, Gujarat State started inspection of the place of discovery and recovered a left leg slipper and right leg slipper approximately at a distance of 5 feet and 2 feet respectively in the south direction from the place of discovery of the dead body. They also recovered an axe with wooden handle at a distance of approximately 1 foot from the place of discovery and various other items not reported here for the sake of succinctness. Among items recovered at a distance of about 2 km from this place, was a broken yellow bangle. The grasses up to a radius of 2 feet from the area of discovery of the dead body appeared pale and compressed with suspected stains. Hence the police also recovered a sample of this grass and grass taken from nearby area outside the marked location which they named as the control grass for laboratory analysis. When the area outside the place of discovery was inspected carefully it was observed that the grasses up to a distance of 5 feet in the north direction and 5 feet in the east direction seemed to be disturbed and appeared compressed as if be due to dragging of some heavy object on them.

The first breakthrough in this case occurred when two witnesses informed police that Ms. X was seen with Ms. Z on the fateful day. Ms. A certain witness informed police that Ms. Z left her place to cut wood in the nearby jungle and carried an axe with her. She was accompanied by Ms. X on that day. The police were informed that Ms. Z was wearing a yellow bangle on that day which appeared similar to the one recovered by police at the place of discovery of the dead body. Similarly, a second crucial breakthrough happened when Ms. B testified that she saw Ms. X and Ms. Z leaving the place together when she was washing clothes in the open hand pump of the village before she herself returned to her house. Ms. Z was made the primary suspect in this case and the police also recovered broken yellow bangles from her house which appeared similar to one recovered from the place of discovery of the dead body. The cloth worn by the suspect on the day of the incident was also collected by police.

The police wanted to ascertain the fact that whether Ms. A and Ms. B seeing Ms. X and Ms. Z together was a matter of chance or not? Since the police found approximately 5 feet of grass to be compressed in the both north and east direction from the area marked as the place of discovery of the dead body, they had to work upon three possibilities. Number one, the crime happened in another location and the dead body was then dragged and was dumped in the site of discovery. It was also possible that the victim was attacked by wild animals and dragged by them to the place of discovery owing to the fact that many organs were missing from the dead body and the location was near to dense jungle. The third and most convincing possibility was that the place of discovery was indeed the place of occurrence of the crime. Since a broken bangle was discovered from the place of discovery of the dead body and a similar piece from the house of accused Ms. Z, it essential for the police to fix the place of discovery of the dead body as the primary crime scene location. In order to prove this beyond doubt, the police were dependent on the analysis of the scientific evidences collected by the laboratory.

Meanwhile the post mortem report of the forensic pathologists mentioned the cause of death of the victim as due to multiple ante mortem blunt and sharp force injuries sustained on the head, vertebra and spinal cord regions resulting in shock, which might have been inflicted by a weapon like axe with hard wooden part and sharp blade part. The time since death was mentioned between 3 to 7 days prior to the date of post mortem. The report also mentioned about the presence of few post mortem injuries on the victim, and this along with the absence of certain body parts was attributed to biting of wild animals. The forensic pathologists collected control teeth sample from the deceased and also handed over the green saree, cream coloured petticoat and maroon coloured blouse worn by her together with a maroon coloured hand kerchief to the police for further analysis by Forensic science laboratory. Similarly swab samples from oral, perineal, anal and deep vaginal regions were taken, slides prepared and sent to the lab through police with medical forwarding note for semen analysis to rule out any possibility of sexual attack. Also stomach and liver samples were packed and sent through police for toxicological analysis. The broken bangle recovered from the place of discovery of the dead body and the bangle pieces recovered from the house of the suspect were sent for physical matching. The cloth samples of the victim (saree, petticoat, blouse and handkerchief), various other objects collected from the scene along with the control teeth of the deceased were sent for blood analysis. The axe recovered and grass samples from the place of discovery of the dead body (Fig. 1) and from outside the place of discovery of dead body (Fig. 2) were

Figure 1- *Grass from place of discovery of dead body*

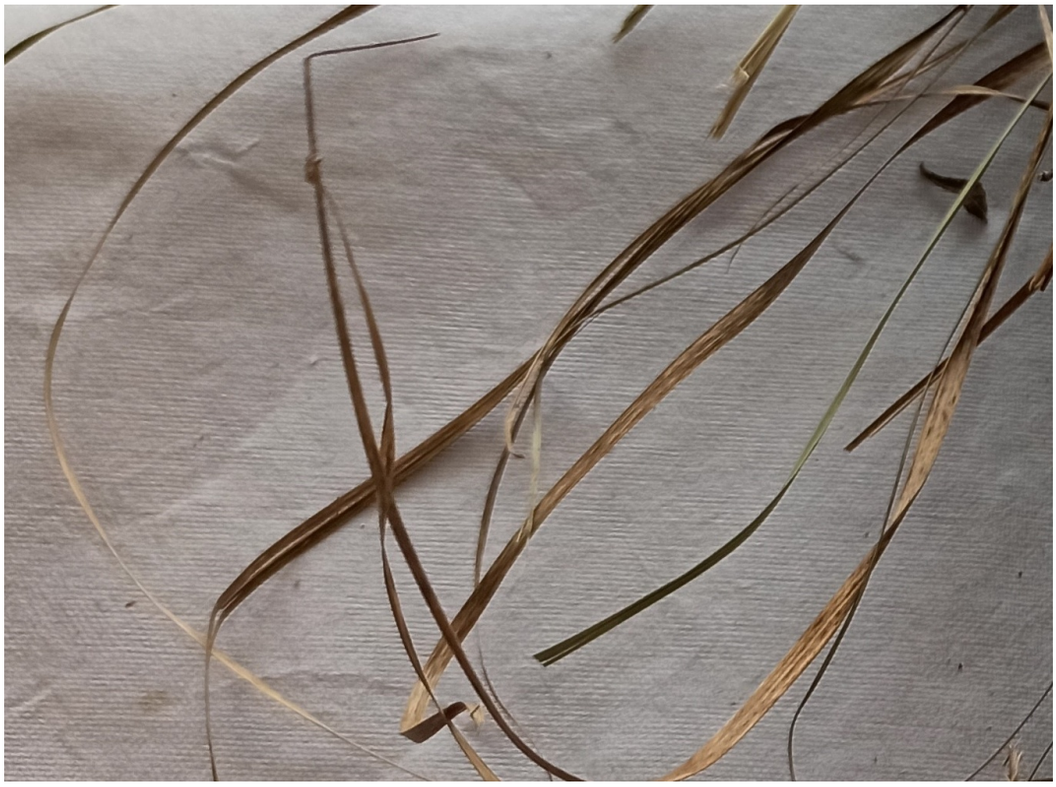

Figure 2- *Grass from place outside the site of discovery of the dead body*

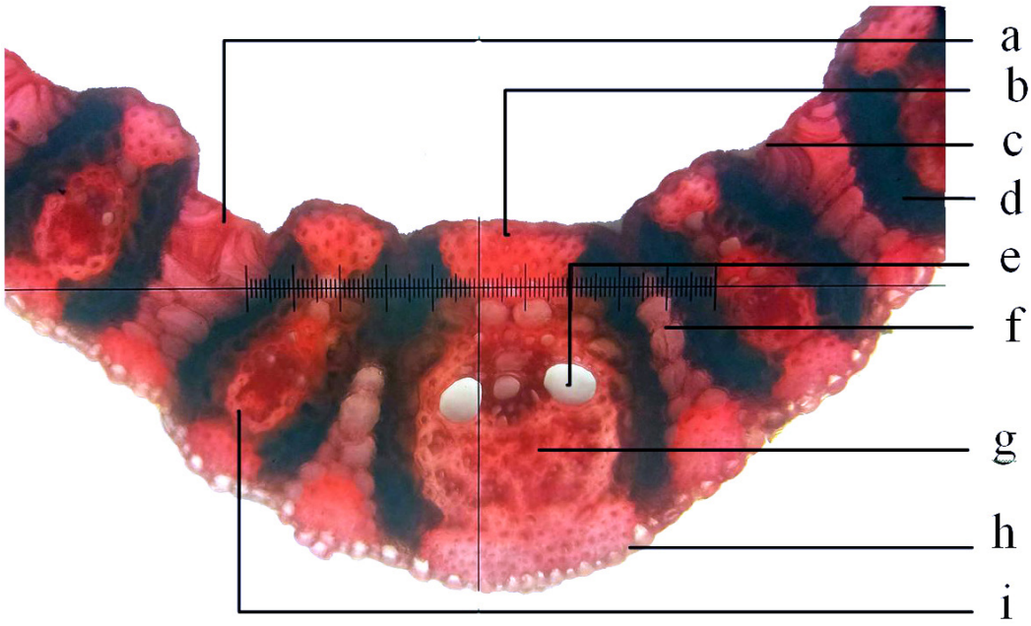

Figure 3- *Anatomical description of grass from place of discovery of dead body*
a - bulliform cell; b - sclerenchymatous cells; c - upper epidermis; d - bundle sheath cells; e -xylem vessel; f - mesophyll; g - phloem; h - lower epidermis; i - vascular bundle

sent to detect presence of blood. Morphological comparison of the grass samples were also sought by the investigating officer.

3. Botanical analysis

For the micro-morphological analysis, the grass samples were cut into thin transverse sections using a razor blade and the sections were stained with safranin and mounded with 50% glycerine with cover slip. Transverse sections were examined and photographed using Leica microscope (DMLA) fitted with DFC 450 camera under bright field light, The Magnifications are indicated by a scale bar.

The detailed transverse sections of the grass samples were taken from the place of discovery of the dead body (Fig. 3) and from outside the place of discovery of the dead body (Fig. 4), and also grass pieces taken from the deceased's petticoat (figure not shown as the results were kept for internal reference). When examined under a microscope, the internal structures of the three grasses were examined, and according to this, the cross-sectional view of the grass's outer surface shows a single layer of upper epidermis with a few bulliform cells and a uniformly arranged single layer of lower epidermis. between the upper and lower epidermis, present various sizes and shapes of unicellular type mesophyll tissue embedded with parallel arranged, collateral, closed vascular bundles circled by a layer of bundle sheath tissue, all the vascular bundles capped with lignified sclerenchymatous fibrous tissue on both sides, various sizes of the vascular bundle consist of xylem towards the periphery and phloem towards the lower side [2, 3]. The lab results indicated that the grass collected from the scene of discovery of the dead body and the grass collected from the nearby control area matched. Botanical analyses of plant material recovered from the scene demonstrate that the grass fragments associated with the body and those collected from the immediate recovery site are morphologically and structurally consistent. Because plants may

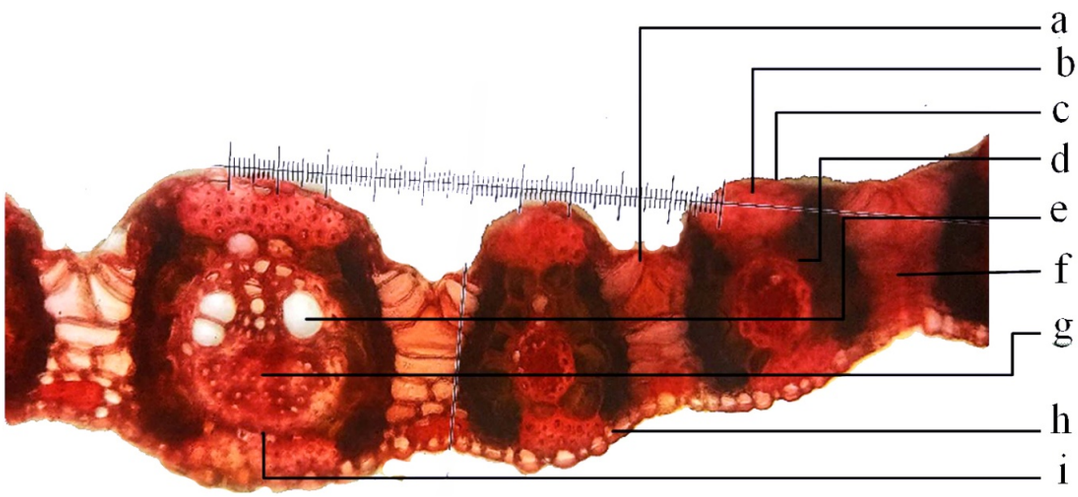

Figure 4- *Anatomical description of grass from place outside the site of discovery of the dead body a - bulliform cell; b - sclerenchymatous cells; c - upper epidermis; d - bundle sheath cells; e -xylem vessel; f - mesophyll; g - phloem; h - lower epidermis; i - vascular bundle*

exhibit similar external appearances while differing in internal anatomy and micromorphology, detailed structural examination is essential in forensic comparison. The concordance observed between the questioned and a reference grass sample provides corroborative evidence that the recovery site and the body share a common botanical context. When considered alongside other forensic findings, these results strengthen the evidentiary basis for the interpretation that the primary offence occurred at the location where the body was found.

crucial finding was the presence of hair strands along with the grasses recovered from the discovery place of the dead body. The hair samples were seen intertwined or tangled with the grass and mud and were not seen superficially. Moreover when the hair morphology was studied under the microscope it became evident that the hairs were cut rather than ones with roots and tissue material adhered (which ruled out the possibility that the hairs recovered were the ones which might have been shed due to natural decomposition process). This clearly proved that the deceased was attacked by a weapon in the same place of discovery of the dead body indicating it to be the primary crime scene. It was ruled that the sharp trauma might have cut the hair of the victim leading them to get entangled or intertwined with the grass and mud. Further, the grass sample along with the cloth of the victim and oral and anal swab, axe and the jacket tested positive for blood. Since none of the exhibits tested positive for semen the possibility of sexual attack was ruled out. The control grass did not test positive for blood. Since the compressed grass outside the place of discovery (the primary crime scene) lacked blood it clearly proved that the most probably the victim might have been dragged by the accused (one or more) first and was then attacked. This also indirectly proved that the place of discovery was indeed the primary crime scene rather than the being the secondary crime scene as if the victim might have been attacked in another location and her body dragged and dumped in the place of discovery. In such a scenario, the surrounding grass would have also tested positive for blood, which was not the case. One another possibility of the deceased being attacked by wild animals and her body dragged by them was also ruled out as this would have also resulted in blood trails in and around the compressed grass region. The forensic

pathologist also opined that the cause of death of the victim was due to shock and haemorrhage as a result of sharp and blunt force injuries sustained in head, vertebra and spine regions which might have been imparted by the perpetrator of the crime using a weapon like an axe and the injuries caused by the animals were only post-mortem in nature.

The morphological analysis of grass and the presence of cut hair and blood helped the investigating officer to fix the place of discovery of the dead body as the primary crime scene.

The weightage of the items recovered from the primary crime scene is always more as this is the place where the actual crime has occurred and it also helps in linking the victim and perpetrator. The biological and especially the botanical analysis was able to reconstruct the events on the day of commitment of crime. Since in this case report we wanted to emphasize the importance of botanical evidences in fixing the primary crime scene rather than any other biological or physical evidences which might have contributed in solving the case we are not discussing about the other results in detail in the case report. The police subsequently registered a case of homicide based on their own investigation and based on the results of the scientific analysis.

During the course of investigation it was found that the motive for the homicide was the victim having an illicit affair with the husband of the accused and hence the accused wanted to get rid of her. The broken bangle matched with the bangle recovered from the house of the accused. The prosecution theory was made on the result of the scientific evidences and it was hypothesized that Ms. X the victim and Ms. Z the accused on the crucial day went to the field to cut wood where chain of events might have led to the attack of the victim by the suspect with the murder weapon- the axe resulting in the death of the victim. This case study indicates that botanical evidences can be crucial in helping to understand the dynamics of the crime and help to link the victim and suspect to the scene of crime directly or indirectly.

4. Discussion

Forensic botany deals with use of botanical evidences for crime investigation. Many studies have demonstrated the usefulness of botanical analysis in solving crimes. Margiotta et al [4] have reported how study of bryophytes helped in reconstruction of an accident. Study of botanical evidence has helped in conviction of suspects in murder cases [5]. The macroscopic anatomical features of bark samples and their forensic significance has been reported [6]. The manner and cause of death has been determined using botanical evidences [7]. Studies have demonstrated the usefulness of botanical evidences in reconstructing the dynamics of trauma from high fall [8].

As public prosecutors are many times unaware of the significance of botanical evidence this paper will help to understand the importance of such evidence. Use of botanical evidences in courts has helped the justice delivery system [9]. The determination of post mortem interval, evidence for post mortem transfer of victim, identification of primary crime site, identification of the victim's dismemberment site, identification of murder weapon etc has been reported earlier [10].

The case discussed in this report was indeed a much highlighted case in the media from the concerned district of our State, since it was the first case of a women murdering a woman in the entire district. Since no eye witness were available to testify the dynamics of the events of the scene of crime and since no surveillance cameras were present, careful observation of botanical evidences has resulted in understanding the chain of events which

might have occurred during the day of commitment of crime. From the case study it was established that a small piece of information extracted from botanical evidence was able to reveal mammoth information. The primary crime scene establishment was very much essential in this case to corroborate other items recovered from the scene of crime to connect the dots. Since the purpose of this report is to demonstrate the utility of botanical evidence, other corroborating factors such as biological and physical specimens have not been discussed here and left to the purview of the investigating officials and the judiciary. Forensic botanical investigations are less commonly used and its full potential is yet to be reached.

5. Conclusion

We conclude our paper by presenting the results of the botanical evidence which has served as an important corroborative evidence in determining the primary crime scene. .

Conflict of interest

The authors declare no competing interests.

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References

1. Ward J, Peakall R, Gilmore SR, Robertson J (2005). A molecular identification system for grasses: a novel technology for forensic botany. Forensic Sci Int 152(2-3):121-131. doi: 10.1016/j.forsciint.2004.07.015.
2. Metcalfe CR. Anatomy of the monocotyledons. Vol-6, Oxford, Clarendon, 1972.
3. Eames J, MacDaniels LH. An Introduction to Plant Anatomy. Second Edition,McGraw-Hill book company INC. London. 1947.
4. Margiotta G, Bacaro G, Carnevali E, Severini S, Bacci M, Gabbrielli M. Forensic botany as a useful tool in the crime scene: Report of a case (2015) J Forensic Leg Med 34:24-28. doi: 10.1016/j.jflm.2015.05.003.
5. Wiltshire PE, Hawksworth DL, Webb JA, Edwards KJ (2015). Two sources and two kinds of trace evidence: Enhancing the links between clothing, footwear and crime scene. Forensic Sci Int 254:231-242. doi: 10.1016/j.forsciint.2015.05.033.
6. Caccianiga M, Compostella C, Caccia G, Cattaneo C (2021). Contribution of plant anatomy to forensic investigation: Tree bark morphology. Forensic Sci Int 318:110598. doi: 10.1016/j.forsciint.2020.110598.
7. Aquila I, Ausania F, Di Nunzio C, Serra A, Boca S, Capelli A, Magni P, Ricci P (2014). The role of forensic botany in crime scene investigation: case report and review of literature. J Forensic Sci 59 (3):820-824. doi: 10.1111/1556-4029.12401.
8. Aquila I, Sacco MA, Ricci P, Gratteri S (2019). The Role of Forensic Botany in Reconstructing the Dynamics of Trauma from High Falls. J Forensic Sci 64(3):920-924. doi: 10.1111/1556-4029.13934.
9. Kasprzyk I (2023). Forensic botany: who?, how?, where?, when? Sci Justice 63(2):258-275. doi: 10.1016/j.scijus.2023.01.002.
10. Caccianiga M, Caccia G, Mazzarelli D, Salsarola D, Poppa P, Gaudio D, Cappella A, Franceschetti L, Tambuzzi S, Maggioni L, Cattaneo C (2021). Common and much less common scenarios in which botany is crucial for forensic pathologist and anthropologists: a series of eight case studies. Int J Legal Med 135(3):1067-1077. doi: 10.1007/s00414-020-02456-0.