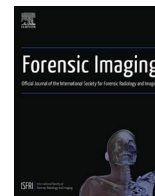




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Case report

Virtual autopsy in COVID19 positive sudden death of a young adult male; a forensic case report

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ABSTRACT

COVID-19 pandemic has changed the way medical professionals worked earlier. Every branch of medicine has revised its protocols to minimize transmission of infection among healthcare workers, and the branch of forensic pathology is no different. Conventional autopsies are generally not recommended in COVID cases as they pose the risk of transmission due to aerosol-generating procedures. However, there have been more than one occasion where the above recommendation has created ethical dilemmas in medicolegal autopsies. To the best of the author's knowledge, this is the first known case of COVID-19 sudden death being investigated through a virtual autopsy in the Indian setting. The case further strengthens the notion of the virtual autopsy being sufficient in demonstrating the relevant findings for the purpose of the cause of death in a certain category of medicolegal cases.

1. Introduction

The sudden death of a young person commonly raises suspicion of foul play, and the criminal investigating agencies have no other option but to seek assistance from forensic pathologists. In India, the inquest in these cases is conducted under Section 174 of CrPC [1]. However, this has become very tricky during the COVID-19 pandemic, where the government [2,3], as well as many international scientific bodies [4–6], have issued many guidelines against conducting autopsies in COVID cases.

In this scenario, whole-body PMCT examination is one such modality that is routinely utilized in many countries in virtual autopsy along with other non-invasive/minimally-invasive techniques [7,8] can be utilized. In cases where the deceased has been previously medically managed, the forensic pathologist can review all the antemortem medical records. However, this luxury may not be available in cases of sudden death. The authors also encountered a similar situation which is being briefly discussed in this article.

2. Case description

A 29-year-old male academician working in an engineering institute was found unconscious with bleeding from the mouth and nose in his hostel. He was immediately taken to a nearby emergency medical facility. On examination, his GCS score was E1V2M5, with both the pupils mid-dilated and not reacting to light. All other vital parameters were deranged (heart rate- 112/min, Blood pressure- 200/116 mm of Hg, random blood sugar- 186 mg%), except for his oxygen saturation. He was briefly managed conservatively and referred to our center for further management due to his deteriorating condition. However, on arrival in ER, he was non-responsive and was declared brought in dead, and the police department was intimated as per protocol. Nasopharyngeal swab examination, which is carried out in all such brought dead cases as per institute protocol, reported positive for COVID-19.

Owing to a case of young adults and family members suspecting foul play, the investigating officer requested a post-mortem examination. In the absence of the standard infrastructure for performing high-risk autopsies [9], it was decided to perform an external examination coupled with photography followed by a whole-body CT examination. Like the

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majority of the Forensic Pathology departments across the globe, we also lacked a dedicated CT machine for post-mortem examination, and hence assistance from the Dept of Radiodiagnosis was sought. The deceased was subjected to whole-body CT at a dedicated facility for COVID-19 patients.

2.1. External examination

The dead body was of a well-built adult male. Moderate decomposition changes were present over the upper part of the body in the form of greenish discoloration, marbling, and peeling of skin at places. Purge fluid was oozing from the nostrils and mouth. There was no sign of any external injuries on the body. No conjunctival hemorrhage was present. Attempts to draw blood from the femoral artery and urine via supra-pubic aspiration were unsuccessful. A bunch of scalp hair was plucked, wrapped in an aluminum foil, and placed in a self-sealing plastic pouch for toxicological analysis.

The body was packed in multiple layers of polythene sheets and was transported to the nearby COVID dedicated CT scan facility. Whole-body non-contrast PMCT was performed on a Philips iCT 256 multislice CT machine. The deceased was laid in the supine position with arms adjacent to the body, Sequential 1 mm and 5 mm axial images (120 kV, SW 1mm, 100kV SW 5mm) were taken with appropriate reconstruction. The whole scan took about 10 min. The reporting radiologist was briefed about all the clinical history as well as postmortem findings before the imaging procedure to correctly interpret the findings in the presence of decomposition changes. Once the radiologist was convinced of all the necessary parameters being captured by reviewing the acquired data, the body was placed into a body bag and transported back to the mortuary.

2.2. Whole-body PMCT report

The time interval between death to CT scan was about 48 hours. In the head region, acute intracerebral hematoma measuring 6.9 x 4.8 x 4.1 cm with surrounding edema in the right capsulo-ganglionic region was observed with left intraventricular extension (Fig. 1, Fig 2). There was compression of the lateral ventricle with a midline shift of 1.7 cm

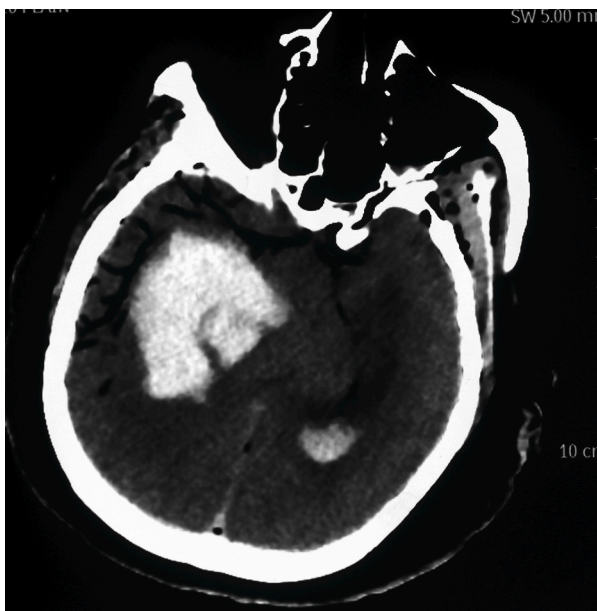


Fig. 1. CT Head Axial view: Acute Intracerebral hematoma in the right capsulo ganglionic region surrounded by edema. Also, note the hematoma extending into the left lateral ventricle extension. There is mass effect in the form of right lateral ventricle compression and a midline shift towards the left.

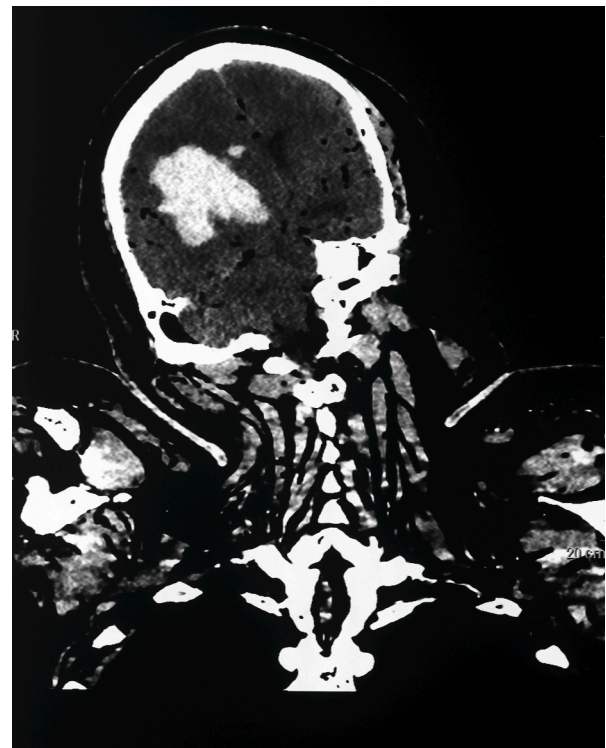


Fig. 2. CT Head and neck, Coronal view: Air is seen diffusely in the arteries of the neck, infra and supratentorial brain, IJV, bilateral sigmoid sinuses, basal cisterns, both orbits, and spinal canal.

towards the left side. Bilateral cerebellar tonsillar herniation with compression of the fourth ventricle was also noted. Diffuse free air was observed in various planes (subcutaneous, intramuscular, intraosseous, intravisceral), thoracic and peritoneal cavities, both orbits, both infra and supratentorial regions of the brain, bilateral sigmoid sinuses, basal cisterns, spinal canal, and blood vessels of the neck (Fig 3). Bilateral pulmonary diffuse ground-glass opacities with minimal right pleural fluid were predominantly seen over the dependent aspects (Fig 4). No other abnormality was detected in the abdominal cavity except for decompositional changes. No fractures were noted in the head, neck, abdominal, thoracic, or upper and lower limbs.

2.3. Cause of Death

The postmortem CT findings were appropriately interpreted considering the clinical history as well as post mortem examination findings. After considering the medical records, external examination findings, and whole-body PMCT findings, it was concluded that “Cerebral edema with bilateral tonsillar herniation consequent to Hypertensive intracerebral bleed” was the cause of death in this COVID-19 case, and the manner of death was classified as natural. Both the IO & the relatives were briefed about the procedures that were made use of in the investigation, and all their concerns relating to the procedures were clarified.

3. Discussion

Similar to the highly contagious nature of SARS Cov2 in the living, there is also a likelihood of transmission of infection from the dead [2,5, 6]. Handling dead bodies during packing, transportation, or autopsy has been categorized under high-risk procedures (AGP), and health care workers are advised always to wear recommended PPE (N95 respirator, face shield, booties, plastic apron, hair net, and double gloves) [9]. In this context, many national as well as international guidelines from

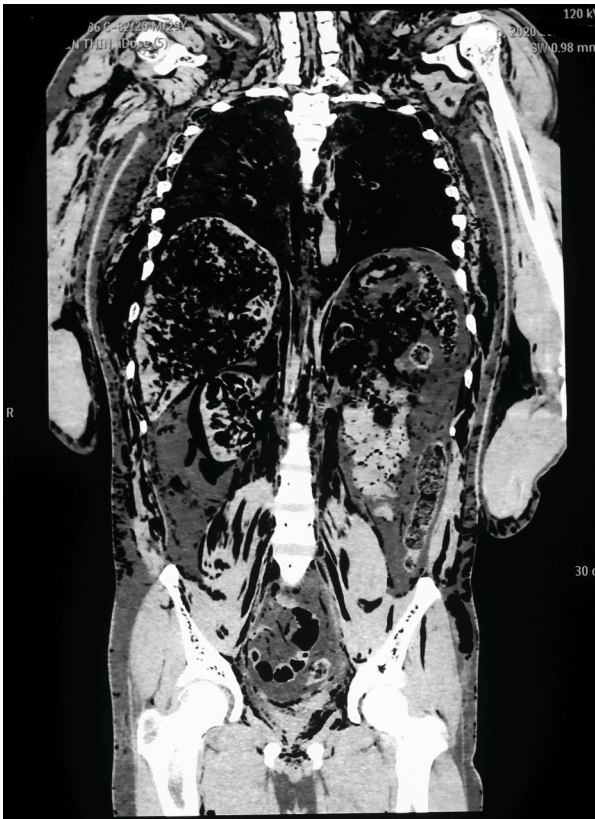


Fig. 3. CT of the torso, coronal view: Post mortem decomposition gas in the form of diffuse subcutaneous emphysema. There is diffuse free air in subcutaneous, intramuscular, intraosseous, and intravisceral planes, including thorax and abdomen.

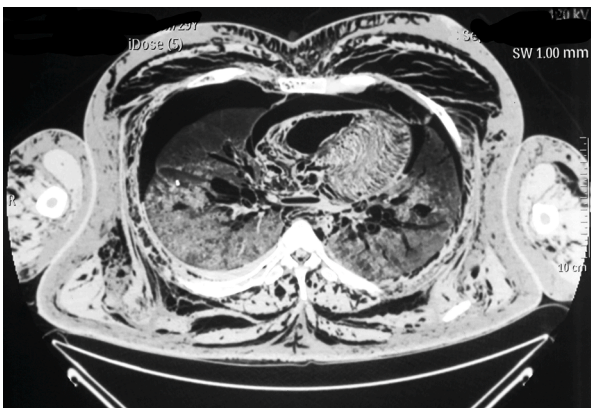


Fig. 4. CT Lung Axial view: Bilateral pulmonary diffuse ground-glass opacities along with right-sided minimal pleural fluid, more on the dependent aspects.

scientific bodies advise against conventional autopsy and mandate proper infrastructures like airborne infection isolation rooms (AIIRs), powered air-purifying respirators (PAPRs), and biosafety level 3 mortuary setup. In the absence of the above facilities, COVID-19 cases are not to be subjected to the conventional autopsy, and the same was followed in this case also [6,9]. The use of noninvasive methods like whole body X-ray, PMCT in tune with the concept of Virtual Autopsy is also being recommended by scientific bodies [2,3,5]. Also, the exclusive use of noninvasive methods to establish the cause of death is not unknown [10]. Similar methods were adopted in this case, also keeping in view that at no point in time, the carriage of justice was hampered. Also, most of the autopsy protocols had been tweaked to facilitate only the

medicolegal requirements, i.e., to ascertain the cause and manner of death mainly and not to seek out the organ pathology per se [11].

3.1. Clinical Differential Diagnosis

The comatose condition of the patient and pupillary reflexes observed at the primary health center suggested extensive brain damage. The clinical findings of the deceased such as low GCS score (E1V2M5), bloodstains around the mouth and nose, blood pressure of 200/116 mm of Hg, were all consistent with a diagnosis of acute cerebrovascular accident (CVA) consequent to malignant hypertension.

3.2. Feasibility and justification of PMCT scanning during the current Pandemic

Nowadays, CT machines are commonly available even at all district hospitals, and so is the expertise to operate them and interpret the findings. Most of the medical institutes have segregated the radiological facilities based on the COVID status of the patients. Also, for obvious reasons, the procedure of subjecting a properly packed COVID-19 positive body to PMCT is much safer than subjecting any living case. Irrespective of the scan results to identify a fatal finding, it will at least assist in excluding any evident disease or deformity.

3.3. Pre-Autopsy confounders

Our institute always has a high load of medico-legal cases, which was further stretched during the pandemic. This has led to unprecedented pressure on the workforce and infrastructure of the mortuary. COVID-19 positive/suspected bodies are stored in a temporary walk-in cold room which has been recently constructed just outside the mortuary complex to meet the COVID challenge. This was mainly for those bodies on the gurney to be released within a few hours of their death. The decomposition changes seen over the body, in this case, could be due to the delay in the postmortem examination while waiting for the results of the COVID test.

3.4. External examination and body fluid sampling

There were no marks of any external injury, which excluded the possibility of trauma. Also, there were no external features suggestive of poisoning. Blood and urine samples were already collected at the referral hospital, and hence failure to collect these samples at autopsy due to various technical reasons had little implications on the outcome of the case. We strongly recommend this practice of collection and preserving of antemortem samples for medicolegal purposes as they are invariably superior to postmortem samples [12]. The scalp hair was provided to rule out chronic exposure [13] to any drug/toxic substances, which may likely have a bearing on this case.

3.5. Differential diagnosis of COVID-19

With no significant past medical history and the availability of a single high blood pressure reading, it was inferred as a case of malignant hypertension. Specific pathophysiology of long-standing hypertension could not be assessed radiologically, and the same was also not obligatory as per the revised autopsy protocol of the department. It has been reported that COVID-19 more likely causes thrombotic vascular events than hemorrhagic events [14,15]. The Ground glass appearance (Fig. 4) of lungs on PMCT suggested either COVID-19 infection or postmortem changes [16,17]. However, the deceased being asymptomatic before his death and the anatomical location of the lesions suggest more of a postmortem phenomenon.

3.6. Ethical issue

Use of a single CT machine for both the living and the dead: This was one of the major concerns of the Department of Radiodiagnosis. But certainly, any dept dealing with the living may have such issues due to socio-cultural perception. Though this looks to be unethical at first glance, but there are many examples in the healthcare setup where these arguments hold no value, for instance, reusing of the hospital beds or gurneys every time a patient dies or when using OT equipment in brain dead cases for transplant purposes. This mindset of clinicians or the general public should change over due course of time.

3.7. Legal issue

Advanced digital techniques are already in applications in the medical field to arrive at the diagnosis and deciding treatment protocol in the living. These are already being used as evidence in the court of law, and hence the authors find no reason for not extending the applicability of such technology in cases after death. Also, it is an established fact that postmortem CT can successfully demonstrate the medicolegal relevant findings to establish the cause of death beyond doubt [10,18] and complies with all the relevant legal requirements as provided in various laws such as S.174 CrPC, IT Act, IEA act, SWGDE guidelines, SWGIT guidelines [1,19-22].

3.8. Limitations

It would have been better if virtual findings could have been confirmed through conventional mode but the lack of COVID 19 compliant mortuary infrastructure prevented the authors from adopting this modality, as such also not advisable [2-5]. Post-mortem angiography could have assisted in determining the exact bleeding source and etiology of the hypertensive disease but could have only delayed the handing over of the body and further decomposition.

4. Conclusion

The present case has opened up the doors of new opportunities for the Indian forensic fraternity. In this case, Postmortem CT could successfully demonstrate the intracerebral bleed, which was sufficient to establish the cause of death beyond doubt. The radiological findings of intracerebral hemorrhage are well-known in day-to-day clinical practice and are frequently encountered in the emergency department [23,24]. As there were no direct or indirect signs of any trauma, the intracerebral bleed was attributed to a malignant hypertensive episode. Thus, PMCT resolved the purpose and also lessened the risk of exposure to infectious agents and may serve as a viable alternative to traditional autopsies in certain cases. These forms of scientific evidence not only strengthen the concept of evidence-based medicine but also are easily reproducible.

Declaration of Competing Interest

None

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