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Reasons for Hematoma during blood sample collection

Dipika Kumari, Anil Kumar*

Biological Sciences, School of Engineering and Sciences, GD Goenka University, Gurugram, Haryana, India

*__Corresponding Author__: anil.kumar1@gdgu.org, dipikakumari1006@gmail.com

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Abstract

Hematoma is a common complication that can occur during blood sample collection. It refers to the collection of blood outside of the blood vessel, leading to the formation of a bruise-like appearance on the skin. This can be a cause of concern for both patient and healthcare provider, as it can cause discomfort and affect the accuracy of the blood sample.Depending on the location and severity, they can range from small bruises to large, life-threatening collections of blood. Common symptoms of a hematoma include pain, swelling and discoloration of the affected area. In some cases, hematoma may also cause numbness or tingling if it compresses nerves.The diagnosis of a hematoma is typically made through physical examination and imaging tests such as ultrasound, MRI or CT scan. Treatment for a hematoma depends on its size and location, but it often involves rest, ice therapy and pain management. Diagnosis of hematoma can be challenging due to its similar symptoms with other conditions such as inaccurate medical history, limited imaging techniques, delayed onset of symptoms and misinterpretation of imaging results.The present research study describes about the reasons of hematoma cause during blood sample collection. Sample count is taken under consideration with the consecutive years such as 2021 and 2022 to identify the reason behind the hematoma during blood sample collection. Quantitative analysis is performed with the secondary data analysis during blood sample collection from the patient. Initiative reason of Hematoma cause is identified by various categories from the total blood sample collection count.

Keywords: Blood samples, Diagnosis, Symptoms, 2021 and 2022, MRI scan, CT scan

1. Introduction

1.1 Theoretical background

Hematomas are a frequent medical issue that arises when there is an accumulation of blood outside the blood vessels [1]. They can occur anywhere in the body including skin, muscles and organs. The word hematoma comes from Greek words “haima” meaning blood and “toma” meaning swelling[2]. This accurately describes the condition, as hematomas are characterized by swelling or lump caused by collection of blood. There are two main types of hematomas: subcutaneous and deep. Subcutaneous hematomas occur just under the skin, while deep hematomas involve deeper tissues such as muscles or organs. Hematomas can occur due to a variety of reasons including trauma, surgery or medical procedures[3]. Injuries such as falls, car accidents and sports injuries can cause blood vessels to rupture, leading to hematoma which is also known as contusion or bruise. Surgical procedures, particularly those involving use of a needle or catheter can also cause hematomas. This is because these procedures can damage blood vessels, leading to bleeding and formation of a hematoma. Certain medical conditions such as haemophilia (bleeding disorder) and liver disease (which can affect the body's ability to clot blood), can also increase the risk of developing hematoma[4]. Symptoms of a hematoma vary depending on its location and severity. In most cases, there will be a visible lump or swelling at the site of the injury. The area may also be tender to touch and skin may appear bruised or discoloured[5].

In more severe cases, hematoma may compress surrounding tissues or organs, causing pain and discomfort. If hematoma is located near a joint, it can limit movement and cause stiffness. In some cases, hematomas can resolve on their own without any treatment. The body has a natural process for breaking down and reabsorbing blood clots. However, for more severe or persistent cases, medical intervention may be necessary. Treatment options for hematomas include rest, ice, compression and elevation (RICE)[6]. This can help to reduce pain and swelling and

promote healing. In some cases, a doctor may also recommend pain medication or prescribe medicines for blood thinner to prevent blood clots from forming. For hematomas, which are large, deep or causing compression of surrounding tissues, drainage may be necessary. This involves using needle or making small incision to remove blood from hematoma. In rare cases, surgery may be necessary to remove hematoma and repair any damaged blood vessels[7]. This is usually reserved for more severe cases or when the hematoma is causing significant pain or discomfort.

There are several types of hematomas, each classified according to their location and cause. The most common type is a subcutaneous hematoma, which occurs just below the skin. This is the type of hematoma that most people are familiar with, as it is often seen as a bruise on the skin[8]. Another common type is an intracranial hematoma, which occurs within skull and can be very serious. Other types of hematomas includes subdural (between brain and its protective covering), epidural (between skull and brain) and intra-abdominal (within the abdominal cavity)[9].To diagnose hematoma, doctor will perform physical exam and ask about patient's medical history and any recent injuries. In some cases, imaging tests such as X-rays, CT scans, or MRIs may be used to confirm the diagnosis and determine the size and location of the hematoma[10]. Treatment for a hematoma depends on its size and location, as well as the underlying cause.

1.2 Significance of the study

- Hematoma is a significant condition which occur with a result of trauma or injury. When person experiences blow, fall or other type of impact to a specific area of the body, it can cause blood vessels to rupture and bleed into the surrounding tissues which can lead to formation of hematoma. The severity of the injury and location of the hematoma can determine the seriousness of the condition.
- It can also be a sign of an underlying medical condition. People with blood clotting disorders, such as haemophilia, are more prone to developing hematomas. In these cases, the body is unable to stop bleeding, which can lead to the formation of hematomas. Additionally, certain medications, such as blood thinners, can also increase the risk of developing hematomas. Therefore, the presence of hematomas can serve as an indication of an underlying health issue that needs to be addressed.
- It can cause a range of symptoms depending on their location and severity. In some cases, they may only cause mild pain and discomfort, while in others, they can lead to more serious symptoms such as swelling, numbness, and loss of function in the affected area.
- If left untreated, hematomas can also lead to complications. As blood accumulates and situates in pressure on surrounding tissues and structures, it can cause damage and interfere with their proper functioning. In some cases, this can lead to permanent damage and disability.

1.3 Problem identification

- Development of hematoma during blood sample collection is improper technique. Inexperienced or careless phlebotomists may fail to properly locate vein and cause damage to the surrounding tissue, resulting in hematoma. They may also insert the needle at an incorrect angle, puncturing the back of the vein and causing blood to leak into the surrounding tissue. This can be avoided by ensuring that phlebotomists are adequately trained and regularly evaluated for their technique.
- Hematoma is leads to the usage of wrong size needle. A needle which is used too large for the vein and cause trauma to the vessel wall, resulting in bleeding and formation of hematoma. On the other hand, needle that is too small may not be able to effectively draw blood, leading to multiple attempts and increased risk of hematoma. It is essential to use appropriate size of the needle for patient's vein to prevent this problem.
- The use of worn-out or faulty equipment can increase likelihood of developing hematoma during blood sample collection. Needles that are dull or have burrs can cause damage to the vein, leading to bleeding and hematoma formation.

1.4 Objectives of the study

- To overview the role of phlebotomist in the blood sample collections among the patients.
- To evaluate the hematoma rates caused due to the improper syringe usage of phlebotomist.
- To assess the factors contributing the phlebotomy hematoma conditions in the patients.
- To recommend the framework for phlebotomist to minimises the hematoma occurrences during blood sample collection.

1.5 Paper Organization

Section 1 describes about the theoretical background of the hematoma condition individual, significance of the research study, problems faced because of hematoma during blood sample collection and objectives of the research investigation. Section 2 implements about the existing studies of the hematoma research during the process of the blood collection. Section 3 elaborates about the methodology process of the samples collected by

the reason of hematoma during blood collection from individuals. Section 4 illustrates about the results which are collected from hematoma individuals by various reasons. Section 5 depicts about the discussions that are researched previously in hematoma and compared with the present research. Study 6 presents the limitations of the research. Section 7 represents about the concluded points of the present research.

2. Literature review

There were 78 cases of Retroperitoneal Hematoma (RPH) included, covering both traumatic and spontaneous bleeding. Spontaneous bleeding without the use of anti-thrombotic agents was the most frequent scenario. Zone 3 haemorrhage was the most frequently seen form of retroperitoneal haemorrhage. 59% of patients were effectively treated with medication only. Some people needed surgery, either through laparoscopy, laparotomy, or an interventional radiological procedure. The requirement for vasopressors, spontaneous bleeding and bleeding without antithrombotic agents were all significantly linked to extended hospitalization. During the follow-up period, it was reported that 83% of cases were still alive. Only two patients passed away as a result of haemorrhagic shock[11].During the 3-year timeframe, there were 1220 referrals made, involving a total of 1099 patients. 502 out of these referrals, which accounts for 41.14%, and 479 patients, making up 43.59%, were taking one or more blood thinning medications. 221 of the patients in this group opted for conservative treatment, with males being significantly more prevalent than females. The majority of recommendations suggested a period of 2 weeks for withholding. Out of the 234 referrals, a total of 13 of them were re-referrals. Importantly, there was no substantial variation in the reaccumulation rates among patients instructed to hold off on their blood thinners for 2 weeks compared to those told to discontinue for more than 2 weeks[12].

Patients who underwent surgery for unilateral symptomatic cSDH in our department from November 2016 to May 2020 were included in the study. Symptoms and neurological deficits of patients were evaluated in advance with a study questionnaire. Measurements of hematoma sizes and midline shift values were taken during the first computer tomography scan in order to assess the level of brain compression. A total of 100 patients were examined. Linear regression analysis demonstrated a significant connection between elevated BNP levels and decreased hematoma volumes as well as smaller MLS values. Analysis involving multiple variables showed that the occurrence of a neurological deficit, a hematoma volume less than 140 mL, older age, and head trauma within 24 hours of admission were all separate factors that could predict an elevation in BNP levels. In cases of symptomatic cSDH, elevation of BNP is associated with factors such as neurological deficits and smaller hematoma sizes. Further studies are needed to determine if an increase in BNP levels may occur during the initial phase of hematoma expansion, specifically in the early stages of cSDHneomembrane formation [13].There was a median follow-up time of 4.8 years with 710 patients reaching death at a median age of 84 years old. The total additional deaths over time were 9% after 1 year, 18% after 5 years, 27% after 10 years, 37% after 15 years, and 48% after 20 years. 206 CSDH patients without any other health issues did not experience higher death rates. Increased mortality was associated with low modified Rankin scores upon admission and discharge, alcohol abuse, warfarin use, being 80 years old or older, opting for non-operative treatment and having a non-traumatic cause. Characteristics of hematoma or its recurrence did not have any impact on increased mortality rates. Among the patients with CSDH, dementia was the leading cause of death, while it was the third most common cause in the reference group[14].

The average age of our group was 61.7±9.7 years. Out of the 65 patients, 40% underwent emergency surgery. In general, the rate of survival after one year was 96.9%. The medical group had a 1-year survival rate of 94.9%. Aortic intervention was needed by 46.2% of the medical group after an average of 191±168 days. Having a maximal aortic diameter (MAD) of ≥45 mm indicated a higher likelihood of aortic-related events in the medical group. 21 studies were found for the meta-analysis, involving a total of 900 patients. Surgery performed promptly resulted in higher survival rates among patients with type A IMH [15].In a prior study, 29,342 survivors of SDH were recognized. During the study period, 11.0% of the patients, which is equivalent to three thousand two hundred thirty individuals, returned to the EDs or hospitals with a diagnosis of epilepsy. A higher risk was observed in Black patients compared to White patients with a hazard ratio of 1.45 and a 95% confidence interval. Having status epileptics during the initial admission for subdural hematoma, despite being rare, increased the risk of epilepsy by almost four times. Alcohol consumption, drug consumption, smoking, renal disease, and indicators of injury severity were also linked to epilepsy [16].The first search found 4315 articles, and 12 studies met the criteria for inclusion. Results show a trend towards lower mortality with steroids in combination with standard care, although it is not statistically significant. Nevertheless, significant diversity was noted. Analysis of how sensitive the results are when influential studies are removed showed that steroids may be linked to an increased risk of mortality. Steroids demonstrated a potential advantage in decreasing the likelihood of CSDH recurrence, although there was notable variability. There was no apparent benefit of steroids on functional outcomes at three months, based on modified Rankin scale scores. Moreover, there was a notable increase in the occurrence of negative effects and complications linked to steroids [17].

The performance of predicting hematoma recurrence was evaluated using a logistic regression model. Recurrence occurred in 32.0% of the 381 patients included in the study. With the exception of reduced brain volume after surgery, factors like patient demographics and comorbidities had no impact on recurrence rate. The expanded hematoma categorization was found to be a major indicator of likelihood of repetition. The most frequent occurrences were found in hematomas with uniform characteristics (isodense: 41.4%; hypodense: 45.0%) and those with sedimentation characteristics [18].A sum of 511 individuals were recognized. Anticoagulants and/or antiplatelet therapy were administered to 50.7% of patients. In 68.1% of patient histories, a suspected cause for the hematoma was identified. The mortality rate stood at 3.1% with recurrence observed in 49 patients, representing 9.6%. Patients who consumed alcohol excessively had a higher rate of postoperative complications. After the first surgery, 78.1% of patients showed enhancements in their neurological function. A delayed contralateral surgery strategy for bilateral hematomas demonstrated low recurrence rates [19].

In total, 530 individuals received 636 MMAE treatments. During the initial evaluation, the average thickness of the CSDH was 15 mm, with 31.3% of patients taking antiplatelet medications and 21.7% taking anticoagulation medications. 36 out of 530 patients experienced clinical failure, while 26.3% of procedures resulted in radiographic failure. During multivariable analysis, factors that independently predicted clinical failure included receiving anticoagulation therapy before treatment and having an MMA diameter below 1.5 mm. Conversely, the use of liquid embolic agents was linked to a lower risk of failure. Female sex, concurrent surgical evacuation, and a prolonged imaging follow-up period were linked to nonfailure in cases of radiographic failure. On the other hand, a smaller MMA diameter of less than 1.5 mm, midline shift and super selective MMA catheterization were linked to radiographic failure[20].

3. Methodology

3.1 Study Area

Hematomas are most commonly caused by trauma or injury to the affected area. This can be a result of a fall, sports injury, or a surgical procedure. The force of impact causes blood vessels to rupture, leading to the leakage of blood into the surrounding tissues.Hematoma can also be a sign of an underlying medical condition. These include blood clotting disorders, liver disease, or cancer. Certain medications, such as blood thinners, can also increase the risk of developing hematomas.Study area for research in hematomas should encompass various aspects, including the types, causes, diagnostic methods, treatment options, long-term effects, and impact on quality of life. By addressing these key areas, researchers can gain a better understanding of hematomas and develop strategies to improve their prevention, diagnosis, and treatment.

3.2 Research Design

Well-designed RCT is the most appropriate research design for studying hematoma in individuals. It allows for the comparison of different treatment options and provides a high level of evidence for determining effectiveness. By following a rigorous research design, researchers can gain a better understanding of hematoma and improve the care and treatment of individuals with this condition.Figure 1 illustrates about the stages of hematoma with the colour variation in the individuals.

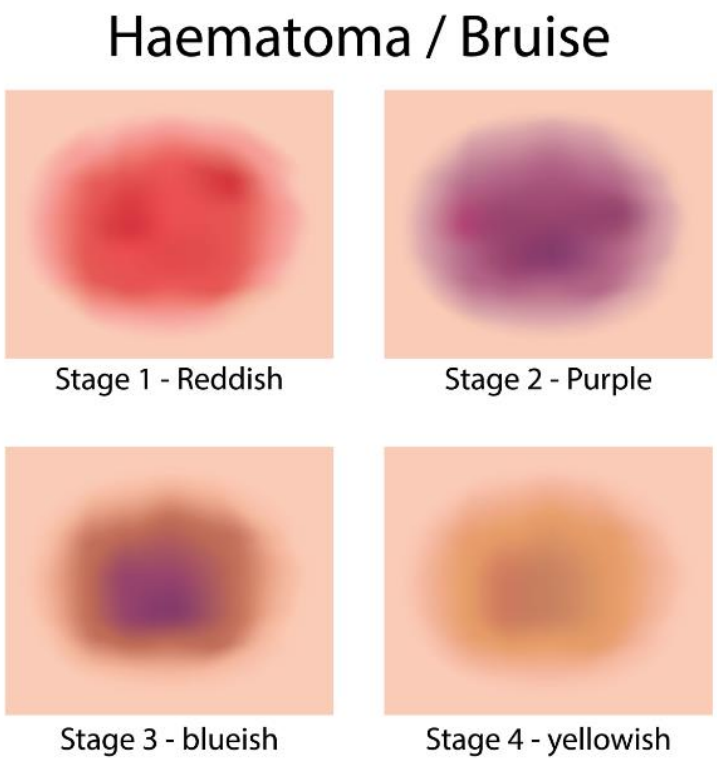

Figure 1 Stages of hematoma with colour variation in individuals

3.3 Sampling method and Participants

The selection of appropriate sampling methods and participants is crucial in hematoma research. Researchers must carefully consider the advantages and limitations of each sampling method and ensure that the sample is representative of the larger population. For hematomas, age and gender may play a significant role as they can affect the risk and severity of hematomas. In the case of hematoma research, the population would include individuals who have experienced hematomas. There are several sampling methods that researchers can utilize, each with its own advantages and limitations. The mechanism of hematoma in the individuals are presented in the Figure 2.

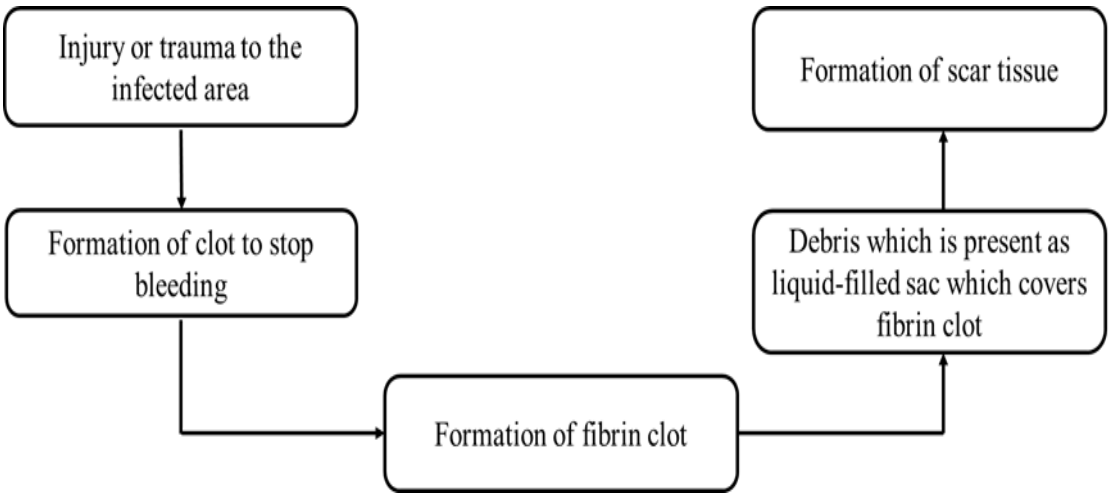

Figure 2 Mechanism of hematoma in all individuals

The mechanism of hematoma formation involves a complex interplay of the body's natural response to injury and the clotting process. When an injury occurs, the body responds by sending platelets and other clotting factors to the site of the injury to stop the bleeding. These substances work together to form a clot, which helps to seal the damaged blood vessel and prevent further blood loss.The key factors in the formation of a hematoma is the location of the injury. In areas with a lot of soft tissue, such as the thighs or buttocks, the body may have a harder

time stopping the bleeding, resulting in a larger hematoma. In contrast, injuries to areas with a lot of bone, such as the shins or forearms, may not lead to a hematoma at all due to the lack of soft tissue to accumulate blood.Mechanism of hematoma formation involves a complex process of clotting, injury response, and natural healing.

3.4 Research Instrument

Diagnosing a hematoma is crucial as it can help in determining the severity of the condition and the appropriate treatment plan. A thorough physical examination, along with imaging tests and blood tests, can help in accurately diagnosing a hematoma. Early diagnosis can lead to prompt treatment, which can prevent complications and promote faster recovery.

1. Needles and Syringes

One of the most common instruments that can cause hematomas is needles and syringes. These instruments are used for a variety of medical procedures, such as vaccinations, blood draws, and injections. When a needle is inserted into the skin, it can sometimes damage small blood vessels, causing blood to leak out and form a hematoma. This is more likely to happen if the needle is inserted at the wrong angle or if the patient has fragile blood vessels.

2. Surgical Instruments

During surgeries, various instruments are used to cut, dissect, and manipulate tissues. While these instruments are essential for the success of the surgery, they can also cause hematomas if not used properly. For example, if a surgical instrument accidentally punctures a blood vessel, it can lead to a hematoma. This is more likely to occur during delicate procedures or when working in areas with dense networks of blood vessels.

3. Physical Examination:

The first and most important research instrument for hematoma is a physical examination. This involves the doctor or healthcare professional visually inspecting the affected area and palpating (feeling) for any swelling, tenderness, or change in skin color. A physical examination can provide valuable information about the size, location, and severity of the hematoma.

4. Ultrasound:

Ultrasound is a non-invasive imaging technique that uses high-frequency sound waves to produce images of internal organs and structures. It is commonly used to diagnose hematoma as it can accurately detect the presence, size, and location of the hematoma. Ultrasound can also help in differentiating hematoma from other conditions such as abscess or tumour.

5. Computed Tomography (CT) Scan:

A CT scan uses a combination of X-rays and computer technology to produce detailed images of the body's internal structures. It is a valuable research instrument for hematoma as it can provide 3-dimensional images of the affected area. A CT scan can help in identifying the extent of the hematoma, any underlying bone injuries, and associated complications.

6. Magnetic Resonance Imaging (MRI):

Similar to a CT scan, an MRI also produces detailed images of the body's internal structures using magnetic fields and radio waves. It is particularly useful in diagnosing hematoma in soft tissues such as muscles, tendons, and ligaments. An MRI can also help in identifying any underlying injuries or complications.

7. Blood Tests:

Blood tests are an essential research instrument for hematoma as they can help in identifying the cause of the hematoma and any underlying medical conditions. A complete blood count (CBC) can show if there is a decrease in the number of red blood cells, which can indicate bleeding. Blood clotting tests, such as prothrombin time (PT) and activated partial thromboplastin time (aPTT), can help in identifying any bleeding disorders that may have contributed to the hematoma.

8. Biopsy:

In some cases, a biopsy may be necessary to diagnose hematoma. A biopsy involves removing a small sample of tissue from the affected area and examining it under a microscope. This can help in confirming the diagnosis of hematoma and ruling out any other conditions.

9. Angiography:

Angiography is a specialized imaging technique that involves injecting a contrast dye into the blood vessels to produce detailed images. It is commonly used to diagnose hematoma in areas with a rich blood supply, such as the brain or abdomen.

3.5 Quantitative analysis

Quantitative analysis of hematoma involves measuring the size, location, and composition of the hematoma to determine its severity and guide treatment. This analysis is crucial in understanding the extent of the injury and predicting its outcome.Accurate measurement of the size and location of the hematoma, as well as analysis of its composition, can provide valuable insight into the injury and aid in its management.Quantitative analysis of a hematoma is to measure its size and location. This is typically done through imaging techniques such as ultrasound, CT scan, or MRI.Larger hematomas are more likely to cause symptoms such as pain, swelling, and restricted movement. They may also put pressure on surrounding tissues and organs, which can lead to further complications.Location is also an essential factor in the analysis of a hematoma. A hematoma in a vital organ, such as the brain or heart, can be life-threatening and requires immediate medical attention.Quantitative analysis is determining the composition of the hematoma. This refers to the types of cells and proteins present in the hematoma and can provide valuable information about its origin and progression.

Hematomas can be classified into two types: acute and chronic. Acute hematomas are usually composed of fresh blood, while chronic hematomas may contain a mixture of blood, inflammatory cells, and fibrous tissue. The composition of the hematoma can be assessed through a procedure called aspiration, where a sample of the fluid is withdrawn and examined under a microscope.The quantitative analysis of a hematoma can also help predict its outcome and guide treatment decisions. For instance, a large hematoma in a critical location may require surgical intervention to prevent further damage and improve recovery. In contrast, a small hematoma in a non-critical location may resolve on its own with conservative management, such as rest and ice therapy.

The composition of the hematoma can also influence treatment decisions. For example, a hematoma with a high level of white blood cells may require antibiotic treatment to prevent infection, while a hematoma with a high number of platelets may require medication to prevent excessive bleeding.

3.6 Ethical Considerations

Hematomas is the issue of informed consent. In most cases, hematomas are harmless and can be treated easily. However, in more serious cases, such as a hematoma in the brain, the treatment may involve invasive procedures or surgery. In these situations, it is important for the healthcare provider to obtain informed consent from the patient or their legal guardian before proceeding with treatment. This means that the patient must be fully informed about the risks and benefits of the treatment, as well as any alternative options that may be available. It is the ethical responsibility of the healthcare provider to ensure that the patient fully understands the potential consequences of the procedure before making a decision.

Ethical consideration is the issue of patient autonomy. This refers to the patient's right to make decisions about their own healthcare. In cases where the hematoma is not life-threatening, the patient should have the right to refuse treatment if they so choose. For example, if a patient has a small hematoma on their arm and does not want to undergo surgery, they have the right to make that decision. However, if the hematoma is causing significant pain or interfering with the patient's quality of life, the healthcare provider may need to intervene and discuss the potential benefits of treatment with the patient.

The principle of non-maleficence, which refers to the duty to do no harm, is also relevant in the ethical considerations of hematomas. While the treatment of hematomas is generally considered safe, there are potential risks involved, such as infection or complications from surgery. Healthcare providers must weigh the potential risks against the potential benefits of treatment and ensure that the benefits outweigh the risks. If the risks are too great, it may be considered unethical to proceed with treatment.

In cases where a hematoma is the result of physical abuse or neglect, ethical considerations become even more complex. Healthcare providers have a legal and ethical obligation to report suspected cases of abuse or neglect to

the appropriate authorities. This can be a difficult decision, as reporting abuse may have consequences for the patient and their family. However, the principle of beneficence, which refers to the duty to do well, requires healthcare providers to prioritize the well-being of the patient and take action to protect them from harm.

4. Results

Month	Samples	ets_Hema	#Bookings	#Bookings	#Tickets_F	#Tickets_F	#Tickets_F	#Rejected	#Tickets_\	Total Ticke
Jan' 2021	78,691	13	4,444	4,300	27	58	257	3,079	222	564
Feb' 2021	89,820	17	5,010	4,859	27	61	210	4,108	204	502
Mar'2021	1,11,311	21	5,838	5,630	53	103	310	5,376	277	743
Apr'2021	1,19,539	7	5,711	5,528	75	187	1,429	6,055	371	2,062
May'2021	1,25,184	11	7,592	7,285	96	204	1,577	6,065	362	2,239
Jun'2021	1,40,724	45	11,122	10,583	108	139	462	8,555	379	1,088
Jul'2021	1,73,909	120	16,516	15,874	94	115	397	14,909	416	1,022
Aug'2021	1,81,324	59	15,308	14,755	74	87	277	15,871	388	826
Sep'2021	1,63,079	46			60	87	223	11,566	393	763
Total	11,83,581	339	71,541	68,814	614	1,041	5,142	75,584	3,012	9,809

Figure 3 Reason behind the basis of hematoma during blood sample collection in the time duration of Jan 2021 to Sep 2021

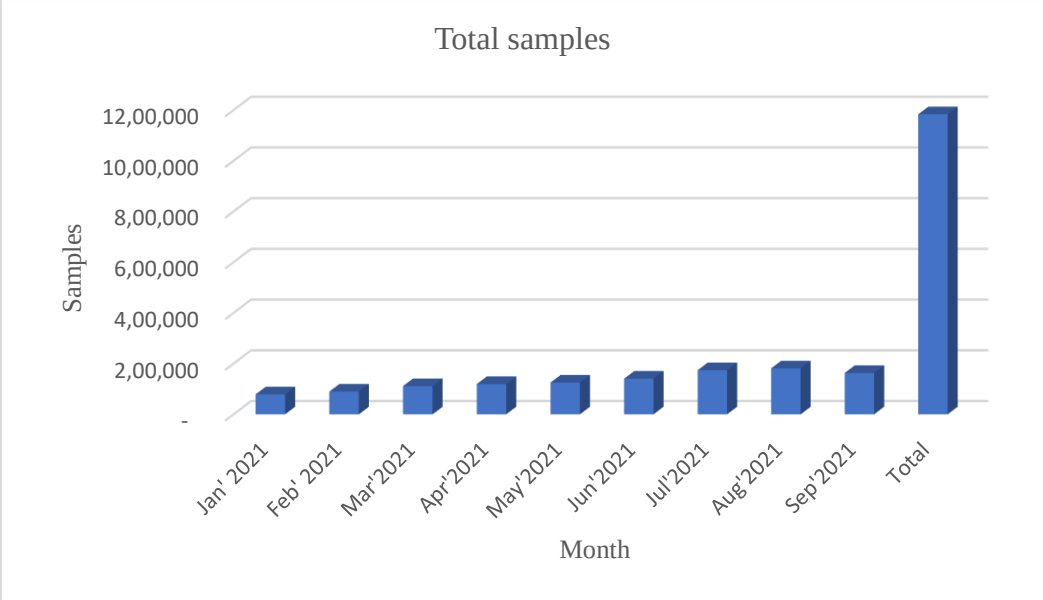

Figure 4 Total samples collected during the time period of Jan 2021 to Sep 2021

The hematoma resulting from blood sample extraction between Jan 2021 and Sept 2021 is depicted in Figure 3. Over the course of 9 months, a total of 11, 83,581 samples were collected, as detailed in Figure 4. There are a total of 339 individuals who were affected by the hematoma. If the phlebotomist doesn't maintain proper hygiene, the total number of samples collected will be 614. Hematoma is formed in the value of 1041 due to the misbehaviour of the phlebotomist while collecting the blood sample. Hematoma resulting from sample rejection on account 75584.

Month	#Samples	ets_Hema	#Bookings	#Bookings	#Tickets_Pl	#Tickets_F	#Tickets_F	#Rejected	#Tickets_\	Total Ticke
Jan'2022	1,28,867	21	29,199	28,666	50	85	464	8,348	457	1,056
Feb' 2022	1,11,153	19	24,339	24,073	26	42	309	7,458	333	710
Mar'2022	1,26,782	35	27,863	27,181	21	35	258	8,945	280	594
Apr'2022	1,17,940	29	22,610	22,061	24	46	266	10,373	232	568
May'2022	1,86,006	39	22,311	21,718	36	35	246	14,989	239	556
Jun'2022	2,84,755	35	24,432	23,942	36	65	368	18,053	247	716
Jul'2022	2,31,349	37	25,821	25,185	33	57	211	16,322	265	566
Aug'2022	2,07,376	51	23,839	23,315	25	53	280	13,044	214	572
Sep'2022	1,69,439	33	19,103	18,698	20	45	324	10,169	178	567
Total	15,63,667	299	2,19,517	2,14,839	271	29	2,726	1,07,701	2,445	5,471

Figure 5Reason of hematoma caused during blood sample collection in the time duration of Jan 2022 to Sep 2022

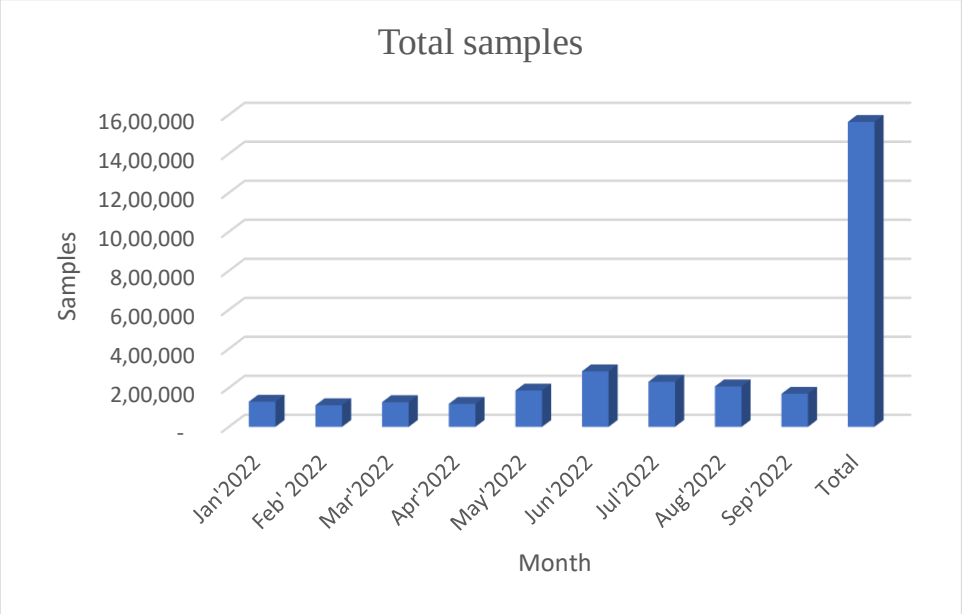

Figure 6Aggregate samples collected throughout the phase of Jan 2022 to Sep 2022

Figure 5 shows the hematoma caused by drawing a blood sample between January 2022 and September 2022. During a span of 9 months, a grand total of 15, 63,667 samples were gathered, as outlined in Figure 6. A grand total of 299 people were impacted by the hematoma. If the phlebotomist fails to uphold good hygiene, the overall quantity of samples gathered will amount to 271. A hematoma occurs at the site of puncture in 29 cases as a result of the phlebotomist's error during blood collection. Sample rejection on account 1, 07,701 causes the formation of a hematoma.

5. Discussions

Out of the 62 articles that were reviewed, 56 were chosen for inclusion. A majority of patients, 55%, were older than the average age of 61.7. Most of the patients were men and the primary indication was difficulty breathing and symptoms typically appeared within a day. Within the group of patients, the vast majority did not use anticoagulants or have coagulation disorders, and the primary cause of injury was falling. The majority of findings from computed tomography showed hematoma in the retropharyngeal area and prevertebral area. At the same time, 2 masses in the retropharyngeal space and 2 RHs were identified through magnetic resonance imaging. Out of 44 cases, over half were closely monitored without any specific treatment, while endotracheal intubation was the most frequently employed method for managing the airway, with 35 cases [21].Out of the 86 patients examined, 24 patients underwent a second surgery with a median time of 2 days between the initial operation and the follow-up surgery. There were no notable variations in patients or injury-related factors between patients who required a second operation and those who did not. The frequency of initial craniotomies was greater in patients

who did not require further surgery. Reoperation was mainly needed for recurrent/significant remaining SDH in 10 patients, contralateral SDH in 5 patients, and expansive intracerebral hematoma or contusion in 5 patients. The ultimate median GOS was 3 for patients who did not undergo surgery and 1.5 for patients who did undergo surgery, with positive outcomes seen in 41.2% of non-surgical patients and 16.7% of surgical patients. [22].

Out of 87 patients evacuated from EDHs, 71 were located laterally. Arterial bleeding was responsible for EDH in 63.4% of lateral EDHs and 9.2% of medial EDHs, with a statistically significant difference. In instances where surgery was primarily performed for treating EDH, 65.3% were found to have an arterial bleed source. In patients treated for conditions other than EDH evacuation, 75% had a venous bleed as the source [23].Out of the 3717 patients who had TLIF surgery at the hospital over the last decade, 46 required additional surgeries, resulting in a total occurrence rate of 1.24%. 12 instances required additional surgeries because of postoperative SEH, with a rate of 0.35%. Univariate analysis found eight factors that may be linked to the risk of postoperative SEH. These include older age, extended thrombin time, elevated alkaline phosphatase levels, and increased number of fusion segments, revision surgery and blood transfusion, use of multiple gelatin sponges or styptic powder during surgery, longer operation duration, and higher blood loss during surgery. During the multivariate analysis, it was found that three factors independently increased the risk: undergoing revision surgery, longer TT, and using multiple gelatin sponges or styptic powder during surgery[24].

There were 10 female and 18 male patients in the study group, with an average age of 51.5±11.9 years. The majority of patients exhibited large adenomas.12 patients showed improved postoperative visual sight, while 11 patients maintained stable sight, and 5 patients experienced worsened vision. It is important to mention that none of the patients had deteriorated vision more than twenty-four hours post-surgery. Of the five patients with visual decline, four had a CT type 3 hematoma, while one had a CT type 2b hematoma. Patients in the type 3 CT group had a significantly higher likelihood of undergoing visual deterioration than those in the type 2 group. Four patients had another operation after experiencing a decline in vision, leading to improved vision after a long period of recovery. Post-surgery hematoma had minimal effects on pituitary dysfunction and hypernatremia [25].

6. Limitations

- The main limitations of a blood sample collection is the potential for bruising and hematoma formation. This can occur due to a number of reasons, including the use of a needle that is too large, the failure to properly secure the needle in the vein, or the puncture of a smaller vein or capillary. Bruising and hematoma formation can also be more likely in individuals who have fragile or easily damaged blood vessels.
- Another limitation is the risk of infection. While the risk of infection from a blood sample collection is low, it is still a possibility. This is because the needle used to draw blood may introduce bacteria or other pathogens into the body. Proper sterilization techniques and the use of a new, sterile needle for each patient can help reduce this risk.
- The main limitations in hematoma research is the limited understanding of how hematomas form. While it is known that a hematoma is caused by the rupture of blood vessels and subsequent pooling of blood, the exact mechanisms and triggers that lead to this process are still not fully understood. This makes it difficult for researchers to develop targeted treatments and preventive measures.
- To study hematoma formation and test potential treatments, researchers often use animal models. However, it can be challenging to replicate hematomas in these models due to the differences in anatomy and physiology between humans and animals. This can lead to limitations in the accuracy and reliability of the research findings.
- Hematoma research often involves invasive procedures, such as biopsies and surgeries, which can pose ethical concerns. This can make it difficult for researchers to conduct studies on human subjects and limit the scope of their research. Animal studies also face ethical constraints, as researchers must ensure the well-being and humane treatment of the animals involved.
- Hematoma research requires significant funding to carry out studies and experiments. However, funding for hematoma research is often limited and prioritized towards other medical conditions. This can hinder the progress of research and limit the resources available for researchers to explore new avenues and potential treatments.
- Diagnosing a hematoma can be challenging, especially in its early stages when there may not be visible symptoms. This can make it difficult for researchers to identify and recruit participants for studies, as well as accurately track the progression of the condition. It can also lead to misdiagnoses and delays in treatment.
- Hematoma research often requires advanced technology and resources, such as imaging techniques and specialized equipment, to accurately study and diagnose the condition. However, not all research institutions have access to these resources, limiting the scope and quality of their research.

7. Conclusion

There are several reasons why a hematoma may occur during blood sample collection. These include improper technique, patient factors, and equipment-related issues.Hematoma formation during blood sample collection can be a common occurrence, it is important for healthcare professionals to be knowledgeable and take necessary measures to minimize the risk.Improper technique can lead to hematoma formation. This can happen when the needle is inserted at the wrong angle or depth, causing damage to the surrounding tissues and blood vessels. It is important for phlebotomists to be properly trained and skilled in performing blood draws to minimize the risk of hematoma.Patient factors such as fragile veins, obesity, or medication use can also contribute to hematoma formation. Fragile veins are more prone to damage during blood collection, while obesity can make it more difficult to locate and access veins. Certain medications, such as blood thinners, can increase the risk of bleeding and bruising.Equipment-related issues can also play a role in hematoma formation. A dull or damaged needle can cause more tissue trauma than a sharp one, leading to a higher risk of hematoma. In addition, using an inappropriate needle size for the patient's vein can also increase the risk of hematoma.Hematomas can be prevented by taking proper precautions and being mindful of your body's limitations. The preventive measures to avoid formation of the hematoma is by using protective gear, warm-up physical activity, maintain healthy diet, avoidance of blood-thinning medication, treating injuries promptly and consideration of taking supplements.

Declarations

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