

# OVERVIEW OF EXAMINATION RESULTS OF PROTHROMBIN TIME (PT) AND ACTIVATED PARTIAL THROMBOPLASTIN TIME (APTT) OF PREGNANT WOMEN BEFORE CAESAREAN SECTION AT BUMI PANUA REGIONAL GENERAL HOSPITAL

Niken Apriyani Abas<sup>1)</sup>, Rita Amini Warastuti<sup>2)</sup>, Titin Dunggio<sup>3)</sup>

<sup>1,2,3)</sup> Bina Mandiri University of Gorontalo

<sup>1,2,3)</sup> Bina Mandiri University of Gorontalo

E-mail: nikenapriyani63@gmail.com

## ABSTRACT

Pregnancy causes physical and emotional changes from pregnant women as well as social changes in the family. Pregnancy in general will continue to develop until a healthy baby is born through the birth canal. However, under certain conditions, sometimes the baby cannot be expelled through the birth canal. In this condition, a caesarean section is an alternative to remove the baby from the mother's stomach because normal delivery does not work and the baby does not come out after 20 hours than it should be. This can be caused by the size of the baby being too large against the birth canal, slowing of the cervical effacement or because the babies to be born are twins who are feared to slow down the birth process.

This study aims to describe the results of the prothrombin time (PT) and activated partial thromboplastin time (APTT) examinations in pregnant women before surgery at the Bumi Panua Pohuwato Regional General Hospital, sub-district of Marisa, district of Pohuwato, province of Gorontalo. This research method used descriptive analysis with a quantitative approach. Sampling used an accidental sampling technique.

The results showed that on the prothrombin time examination, 5 patients (16.7%) had abnormal PT results, while 25 patients (83.3%) had normal PT results. In the activated partial thromboplastin time examination using the same samples, 12 patients (40%) had abnormal APTT results and 18 patients (60%) had normal APTT results. The total sample was 30 pregnant women (100%).

**Keywords:** PT, APTT, caesarean section, pregnant women

## INTRODUCTION

The period of pregnancy starts from conception until the baby is born. During pregnancy, there are physical changes and stimulation in the mother as well as social changes within the family. Usually, the baby is born through the birth canal, but sometimes, due to some circumstances, a normal delivery cannot be realized. [22].

Gestational age is divided into three phases:

1. The first trimester (0-12 weeks) that occurs after fertilization. Chemical progesterone in this trimester has an

important role, namely making and maintaining the lining in the uterus where the egg is attached, providing nutrition to the fetus, and strengthening the lining of the uterine wall. In addition, there is an increase in estrogen which can cause nausea and vomiting, the body feeling weak, tired, as well as enlarged breasts.

2. The second trimester (Sunday 13-27) in which pregnant women will generally feel healthy again because the body is used to absorbing more chemicals.

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Anxiety related to pregnancy in this trimester also begins to decrease. The uterus or stomach of pregnant women has not been too enlarged so that it does not feel heavy. Pregnant women must start preparing for pregnancy and direct their energy and thoughts to positive things. During this trimester, the mother can feel the baby's growth and development and begin to feel the presence of the baby inside her.

3. The third trimester (28-40 weeks) is often called the pause and alert period because in this trimester mothers feel impatient waiting for the birth of their baby. Child development and growing belly are two things that help a mother to remember her child. Usually what is emphasized on pregnant women at this time is that children can be born at any time. This can lead to the mother being careless and the signs and symptoms of labor starting to emerge. In this condition, mothers often feel restless or anxious about the birth of their babies [7].

Based on data from WHO (2015), the rate of delivery by caesarean section in developing countries has increased for almost 30 years by 10% to 15% of all deliveries. Caesarean section is a series of medical indications, separated into signs for the mother and signs for the child. Caesarean section is an alternative to delivery when vaginal delivery is no longer possible. Delivery is generally carried out in a normal way or without complications, but if complications arise, the treatment measures taken will always prioritize the safety of the mother and baby so that caesarean section is an alternative treatment that can be taken [30].

In Indonesia, from the results of the Indonesian - Demographic and Health Survey in 2017, the percentage of deliveries by caesarean section (c-section) was 17.02% [30].

In Gorontalo Province there were 31,714 pregnant women in 2017 while the number of deaths in pregnant and childbirth women in this province in 2019 was 40 people and the highest incidence was in the district of Boalemo. The biggest factors causing death in pregnant women during childbirth include bleeding by 32.5%, heart-lung disorders by 32.5%, hypertension during pregnancy by 17.5%, water embolism by 7.5%, and others by 10%.

Based on data from the Central Agency on Statistics of Pohuwato District in 2019, there were 3,698 pregnant women with normal and cesarean sections.

In 2019, the number of pregnant women who underwent c-section at the Bumi Panua Pohuwato Regional General Hospital of Pohuwato were 1,747 people and in 2020 were 1,641 people.

The term caesarean section comes from the Latin word "caedere" which means to cut or tear. In obstetrics, this term can refer to a medical procedure to deliver child by opening the septum between the midsection of the body and the uterus of a mother [16]

The implementation of caesarean section includes several clinical signs, namely maternal signs and baby signs. This method is performed as an alternative to delivery when vaginal delivery is no longer possible [16].

C-section is medically legal to be performed without any indication as long as the benefits and risks are explained to the patient. This method can prevent or reduce maternal and newborn deaths and can make delivery much safer [16].

A c-section was performed because labor did not occur normally and the baby did not come out after 8 hours from the time it should have been. This can happen because the size of the baby is too large against the birth canal. Other contributing

factors are slow cervical discharge and multiple pregnancy [25].

C-section can have short-term and long-term consequences on maternal health. These risks include bleeding, postpartum infection, breastfeeding delays due to pain due to anesthesia and surgery, and ectopic pregnancy. Babies born by c-section are more prone to allergies, obesity, and asthma. A study performed in Swedish found that babies born by elective c-section were 2.7 times more likely to develop respiratory problems than babies born by emergency c-section [25].

C-section is performed on pregnant women who have a history of poor pregnancy and childbirth, pelvic narrowing, placental detachment, especially third-degree placental detachment, pregnancy complications, pregnancies accompanied by diseases (heart, coronary artery disease), and disorders such as ovarian cysts, myomas, uterus, and so on [18].

The decision to carry out a c-section depends on the condition of the mother and fetus. Mothers who are too young, or too old, are more risky undergoing c-section. There are complications of pregnancy and other labor such as premature labor, pelvic narrowing, premature rupture of membranes, pre-eclampsia, very large baby size, fetal position abnormalities, or babies to be born are twins are the chosen factor in c-section [25].

Data in the field shows that many perform this c-section because of the indication of the position of the baby with the head of the pelvis where there is an imbalance between the fetus and the mother's pelvis so that the fetus cannot come out through the vagina.

Medical procedures are activities with procedures that have the potential to be fatal. In ordinary patients or those who are not seriously injured or dehydrated, this can be easily controlled. However, many

things can happen if the patient has abnormal hemostasis or excessive fluid drainage can occur at the time the prothrombin time (PT) and activated partial thromboplastin time (APTT) tests are initiated [28].

Routine preoperative assessment is performed according to the signs that are related to the clinical condition of patients to anticipate unexpected conditions that may require preoperative care or changes in careful administration. Therefore, it is necessary to carry out a survey of the known medical history, post-operative intricacies, and other examination purposes [28].

Blood is a liquid consisting of plasma and platelets. Blood is in charge of transporting oxygen from the lungs to the tissues and carbon dioxide from the tissues to the lungs to be excreted, for instance, sending supplements from the intestinal system to the tissues, and then carrying metabolic by-products to the excretory organs, namely the kidneys, which serve to provide chemicals and materials for digestion blood coagulation [11].

Blood components consist of:

1. Plasma is a liquid blood that contains clotting factors. The plasma does not contain platelets. Plasma is obtained from blood mixed with anticoagulant which is then centrifuged at a certain time and speed so that plasma can be separated from other components. The plasma has the synthesis of an alternative composition of clotting components depending on the type of anticoagulant added [9].
2. Serum is a liquid of blood that does not contain blood clotting factors and also does not contain blood cells. Blood clotting factors include fibrinogen, prothrombin, factor VIII, factor V, and factor XIII, and factor XII, factor XI, factor IX, factor X, and factor VII. Serum is obtained by taking a blood sample without adding any

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anticoagulant and then allowing it to clot for 15 to 30 minutes. The clotted blood is then centrifuged so that a barrier appears between the fluid and the blood cells. The yellow liquid obtained from the centrifugation process is called serum. Most medical centers use serum as a sample for blood chemistry tests. The serum is generally stored in a regular cylinder without anticoagulant and in a vacuum tube with gel separator [9].

3. Corpuscular blood (solid part of blood) consists of:
  - a. Platelets play an important role in blood clotting. Platelets fuse with torn or damaged endothelial masses of blood to form platelet hubs or clusters. The normal amount of platelets in the blood is around 150,000 - 350,000 cells/ml of blood.
  - b. Erythrocytes (red blood cells) which play an important role in the blood because they contain hemoglobin (Hb). Hemoglobin is a biomolecule capable of binding oxygen and erythrocytes which are affected by the oxygen consumed by the lungs. As blood travels throughout the body, hemoglobin releases oxygen into cells and binds carbon dioxide.
  - c. Leukocytes (white blood cells) are larger than red platelets. In adults, the total amount is around 4000-10,000 leukocytes/mm<sup>3</sup>. Unlike erythrocytes, leukocytes are nucleated and most can move as single cells which can adapt and enter narrow separators [9].

Leukocytes are divided into five types:

1. Neutrophils are the most abundant white platelets representing about 60%. There are two kinds of neutrophils, particularly rod neutrophils (penetrating/cut) and portion neutrophils. Neutrophils are called granulocytes [13].

2. Eosinophils contain orange-red (eosinophilic) coarse granules seen in peripheral blood smears, segmental nuclei (usually two flaps). The capacity of eosinophils is also phagocytic and can act as antibodies, especially against antigens secreted by parasites [13].
3. Basophils contain coarse granules that are purple or dark blue in color and usually cover the segmented nucleus of cells. The least amount is <2% in the total white blood cell count [13].
4. Lymphocytes are non-granulated white blood cells (agranulocytes) which are the most abundant after neutrophils, which is about 20 to 40% of the total white blood cells. The amount is relatively higher in children than in adults and increases if there is a viral infection [13].
5. About 3-8% of all white platelet count is made by monocytes. After 8-14 hours in the blood, monocytes will enter the tissue and become macrophages (also called histiocytes). Monocytes have two capacities, namely phagocytosis of microorganisms and other foreign bodies that play a role in safe reactions [13].

The process of blood clotting is divided into three main stages, namely:

- a. Vasospasm,
- b. Formation of nodes  
platelets → Primary Hemostasis,
- c. Coagulation → Secondary Hemostasis. The hemostasis process will be maintained in balance through the coagulation control mechanism,
- d. fibrinolysis.

Examination of prothrombin time (PT) and activated partial thromboplastin time (APTT) are performed before surgery to determine whether the patient's blood can clot or is difficult to clot. If the blood clots

easily then there will be a risk of blood loss during surgery. If the blood clots easily, then the risk of blood loss during surgery is small but on the other hand it will complicate the operation. If the blood is difficult to clot while the operation is being performed, the blood will continue to come out and can be in large quantities which can cause the patient to lose a lot of blood. PT and APTT examinations are carried out for the benefit of the patient, the doctor performing the operation, and the anesthesiologist working in the operating room [23].

In cases of extreme bleeding or swelling or delayed plasma prothrombin time (PPT) in pregnant women, the test used to evaluate the presence of certain factors is the coagulation test. The PPT test is done as a basic assessment to see if a person has blood clotting problems [12].

Prothrombin time (PT) is a test for the duration of clotting time in the extrinsic and conventional pathways to determine the presence of a bleeding disorder and to evaluate bleeding prevention treatments [23].

There are several coagulation factors related to vitamin K that need to be known, namely factor II, factor VII, factor IX and factor X. The content of fat-soluble vitamins, vitamins A, D, E, and K will decrease. Vitamin K deficiency reduces the synthesis of coagulation factors so that PT results are prolonged. To distinguish the cause of prolonged PT results due to decreased synthesis function or vitamin K deficiency, vitamin K injections can be performed. If 13 days after vitamin K injection the PT results are normal, then the cause is vitamin K deficiency. However, if PT results continues then the possible cause is biliary obstruction [21].

Activated prothrombin thromboplastin time (APTT) is a test of clotting time in the intrinsic pathway. The APTT test is often combined with the PT test to determine the presence of a bleeding disorder and the

potential for severe bleeding during surgery. PT and APTT examinations are routine examinations to determine the risk of bleeding or hemostasis, especially in preoperative patients [15].

Hemostasis is a combined process between platelet activation and coagulation flow to form blood clots that occurs in two pathways, namely extrinsic and intrinsic pathways. Hemostasis can be measured through urine tests such as platelet count, APTT for the intrinsic pathway test, International Normal Ratio (INR), PT for the extrinsic pathway, thrombin time (TT), fibrinogen levels, and fibrin degradation products (FDPs) [3].

The test results under most conditions especially PPT and APTT can be affected by factors analyzed before plasma citrate preparation is carried out. Several factors that need to be considered are starting from the method of blood collection, dosage, homogenization of citrate in the blood, centrifugation, distribution to the sample storage. Analytical factors vary from testing techniques, instruments, measuring instruments to the calibration. Until now there is no uniformity in all laboratories regarding the centrifugation of blood samples containing citrate related to the time and speed in obtaining accurate plasma citrate samples. Plasma citrate can be found in the conditions of plasma platelet-rich plasma (PRP) atau platelet-poor plasma (PPP) [10].

A coagulation meter is an instrument used to measure the capacity of blood to form clots by performing one of several types of tests including prothrombin time, partial thromboplastin, D-dimer test, and factor test. This coagulation meter requires a blood test taken in a test tube containing sodium citrate as an anticoagulant on the grounds that the anticoagulant sodium citrate activity system is reversible [13].

The Ministry of Health's regulation regarding the interpretation of prothrombin time (PT) and activated partial

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thromboplastin time (APTT) test results in a book written by Durachmin and Dewi (2018) under the supervision of the Ministry of Health, the Agency of Empowerment Human Resources of Health as follows:

- a) The interpretation of the prothrombin time test results is normal if it is in the range of 10-14 seconds. Prothrombin time can be accounted for using units of seconds and INR. To decide the result in seconds, the test results can be seen from the table provided by Human (based on the reagent inclusion package used).
- b) The interpretation of the activated partial thromboplastin time test results is normal if it is in the range of 22-27.9 seconds (may vary from one laboratory to another) [4].

Based on the above basis, the researchers took the initiative to carry out a study to obtain the overview of the results of the Prothrombin Time and Activated Partial Thromboplastin Time examinations in pregnant women with pre-cesarean section at the Bumi Panua Regional General Hospital in Pohuwato.

### METHODS

This type of research uses descriptive research with a qualitative approach. The research was conducted at Bumi Panua Pohuwato Regional General Hospital to pregnant women before c-section surgery. The number of samples used in this study were 30 blood samples of pregnant women. Data was collected through observation, informed consent and laboratory examination.

The interpretation of the examination results used in the study was adjusted to the standards applied at the Bumi Panua Pohuwato Regional General Hospital as follows:

1. Normal blood clotting time of PT: 11-18 seconds

2. Normal blood clotting time of APTT: 27-42 seconds.

### RESULTS

Prothrombin time (PT) examination is an examination to measure hemostasis (clotting) which includes a thorough examination of liver function. This test aims to evaluate factor I, factor II, factor V, factor VII, factor IX, and factor X so that it can be used to see the synthetic function of the liver which is more sensitive. Lack of vitamin K intake can lead to decreased synthesis of blood clotting factors by the liver.

The activated partial thromboplastin time (APTT) examination is an examination carried out to assess coagulation abnormalities in the intrinsic and shared pathways, namely Hageman (XII) factor, prekallikrein, kininogen factor, An-Tecedent Plasma Thromboplastin (XI) factor, Christmas (IX) factor, Antihemophilic (VIII) factor, Stuart (X) factor, Proaccelerin (V) factor, Pro-Thrombin (II) factor, and Fibrinogen (I) factor. The Prolonged and shortened clotting results in PT and APTT examinations occur due to deficiency of these factors which can be improved by adding plain plasma to the plasma being tested. PT and APTT examinations are more sensitive and have better reproducibility than manual hemostasis examinations.



**Figure 1.** The results of Prothrombin Time (PT) and Activated Partial Thromboplastin Time (APTT) examinations

(Source: Primary Data, 2021)

The results of the prothrombin time and activated partial thromboplastin time examinations in pregnant women at the Bumi Panua Pohuwato Hospital are presented in tabular form and described with narration. The study was carried out for 2 weeks on July 15<sup>th</sup> – 26<sup>th</sup>, in 2021 at the Laboratory of Bumi Panua Hospital, Pohuwato with a total sample of 30 blood samples from pregnant women who were about to perform a cesarean section.

**Table 1.** Distribution of samples by gestational age

Gestational Age	Frequency	Percentage (%)
0-12 weeks	0	0%
13-27 weeks	0	0%
28-40 weeks	30	100%
<b>Total</b>	<b>30</b>	<b>100%</b>

(Source: Primary Data Primer, 2021)

The data in Table 1 shows that of all respondents who have a gestational age of 28-40 weeks or the third trimester as many as 30 respondents (100%).

**Table 2.** Distribution of samples by prothrombin time examination results

PT results	Frequency	Percentage (%)
Normal	25	83.3%
Abnormal	5	16.7%
<b>Total</b>	<b>30</b>	<b>100%</b>

(Source: Primary Data, 2021)

The data in Table 2 shows that from the results of the PT examination, as many as 5 people (16.7%) had abnormal PT results and as many as 25 people (83.3%) had normal PT results.

**Table 3.** Distribution of samples by activated partial thromboplastin time examination results

APTT Results	Frequency	Percentage (%)
Normal	18	60%
Abnormal	12	40%
<b>Total</b>	<b>30</b>	<b>100%</b>

(Source: Primary Data, 2021)

The data in Table 3 shows that from the results of the APTT examination, as many as 12 people (40%) had abnormal APTT results and as many as 18 people (60%) had normal APTT results.

**Table 4.** Distribution of samples by prothrombin time examination results based on age

Age	PT examination			
	Normal		Abnormal	
	F	%	F	%
20-30 years	13	43.3%	3	10%
31-40 years	6	20%	1	3.3%
41-50 years	3	10%	0	0%
51-60 years	3	10%	1	3.3%
<b>Total</b>	<b>25</b>	<b>83.3%</b>	<b>5</b>	<b>16.7%</b>

(Source: Primary Data, 2021)

The data in Table 4 shows that at the age of 20-30 years as many as 13 people (43.3%) had abnormal PT results and as many as 3 people (10%) had normal PT results; at the age of 31-40 years as many as 6 people (20%) had abnormal PT results and as many as 1 people (3.3%) had normal PT results; at the age of 41-50 years as many as 3 people (10%) had abnormal PT results and none of the respondents had normal PT results; at the age of 51-60 years as many as 3 people (10%) had abnormal PT results and as many as 1 people (3.3%) had normal PT results.

**Table 5.** Distribution of samples by activated partial thromboplastin

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time examination results based on age

<b>APTT examination</b>				
Age	Normal		Abnormal	
	F	%	F	%
20-30 years	11	36.6%	6	20%
31-40 years	4	13.3%	2	6.6%
41-50 years	1	3.3%	2	6.6%
51-60 years	2	6.6%	2	6.6%
<b>Total</b>	<b>18</b>	<b>60%</b>	<b>12</b>	<b>40%</b>

(Source: Primary Data, 2021)

The data in Table 4 shows that at the age of 20-30 years as many as 11 people (36.6%) had abnormal APTT results and as many as 6 people (20%) had normal APTT results; at the age of 31-40 years as many as 4 people (13.3%) had abnormal APTT results and as many as 2 people (6.6%) had normal APTT results; at the age of 41-50 years as many as 1 person (3.3%) had abnormal APTT results and as many as 2 people (6.6%) had normal APTT results; at the age of 51-60 years as many as 2 people (6.6%) had abnormal APTT results and as many as 2 people (6.6%) had normal APTT results.

## DISCUSSION

There are several factors that can cause the results of the prothrombin time (PT) and activated partial thromboplastin time (APTT) to be abnormal, namely due to congenital or other diseases (diabetes mellitus, heart disease), pregnancy disorders in pregnant women, obesity or due to the use of drugs such as blood thinners. The results of the PT and APTT examinations were divided into three categories, namely: normal results, prolonged results (high) and shortened results (low).

If a prolonged (high) result is obtained on PT and APTT examinations, it means that bleeding may occur due to certain conditions in the body of the patients such as the early stages of Disseminated Intravascular Coagulation (DIC) or the formation of abnormal blood clots in the blood vessels, as well as the administration of heparin [6].

If the PT and APTT examinations results are shortened (low), it means that the patient's blood is fast clotting caused by several conditions such as complications of infectious diseases in the bloodstream (sepsis), fever, leukocytosis, tachycardia (rapid heartbeat), or tachypnea (rapid and short breathing) [6].

This study used the blood samples of pregnant women who would perform a cesarean section at the Bumi Panua Pohuwato Hospital in July, 2021 as many as 30 samples.

Based on the results of the prothrombin time examination, 5 samples had abnormal PT results and 25 samples had normal PT results. Based on the results of the activated partial thromboplastin time examination, 12 samples had abnormal APTT results and 18 patients had normal APTT results.

In this study, abnormal results from the PT and APTT examinations were caused by the condition of the patients during pregnancy who experienced tachycardia and tachypnea, as well as at the time of the examination and before surgery. Another cause was the influence of the excess body weight (obesity) which affected the results of both examinations where a blockage occurred in the patient's blood vessels leading to prolonged results (high).

The results of this study are in line with the theory put forward by Fenny, et al (2011) and Nelly, et al (2018), that the results of the Prothrombin Time and activated Partial Thromboplastin Time examinations can shorten in people with



obese people compared to people with normal weight. A high-fat diet is one of the factors that can cause the results of both tests to be shortened, or because of the presence of hemostatic parameters as a predictor of decompensated DIC in septic patients. Sepsis is a systemic response to a bacterial infection with at least two symptoms of the systemic inflammatory response (SIRS), namely fever, leukocytosis, tachycardia, and tachypnea or rapid breathing.

In addition, another theory that supports the results of this study is the theory proposed by Wahida and Tumpuk (2017), that the prolonged (high) examination results are due to the analgesic effect on blood clotting function. Another cause is the physiological state of the patient who is under pressure and stress which stimulate the release of the hormone adrenaline into the blood cycle which interferes with blood clotting.

The reference value used in the PT examination is 11-18 seconds. A total of 3 patients had shortened (low) PT results and 2 patients had prolonged (high) PT results. The reference value used in the APTT examination is 27-42 seconds. A total of 9 patients had shortened (low) APTT results and 3 patients had prolonged (high) APTT results.

## CONCLUSION

The prothrombin time (PT) examination is an examination of hemostasis (blood clotting), including an examination of liver synthesis function. The activated partial thromboplastin time (APTT) examination is an examination performed to assess abnormalities of coagulation in the intrinsic and common pathways.

The study was carried out using a sample of 30 pregnant women who were going to perform a caesarean section at the Bumi Panua Regional General Hospital of Pohuwato. From the results of the

examination, it can be concluded that as many as 5 patients have abnormal PT results, while 25 patients have normal PT results. As for the APTT examination, as many as 12 patients have abnormal APTT results, while 18 patients have normal APTT results. Factors that influence the abnormal results of PT and APTT examinations are anxiety and stress before the surgery to be carried out.

## REFERENCES

- [1] Andi AT., Sri J., Mansyur A. 2021. Pemeriksaan pt – aptt menggunakan coatron ml. makalah dr. Tarau tutorial hematologi.
- [2] Ardina R., Sartika F., dan Nainggolan LP. 2020. Aptt (activated partial thromboplastin time) dan pt (prothrombin time) pada penderita diabetes melitus tipe 2 di rsud dr. Doris sylvanus Palangkaraya. 2 April 2020. *Borneo journal of medical laboratory technology*. volume 2 no. 2.
- [3] Donaliazarti. 2017. Pemeriksaan hemostasis secara komprehensif dengan tromboelastografi. 2017. *collaborative medical journal (cmj)*.
- [4] Durachim A., dan Dewi A. 2018. Hemostasis. 2018th ed. badan pengembangan dan pemberdayaan sumber daya manusia kesehatan. Jakarta selatan.
- [5] Fajrin F. 2016. Analisis hubungan antara pengetahuan, psikologi dan pengalaman bersalin ibu dengan pemilihan proses persalinan normal atau caesarea pada pasien melahirkan di rsia hermina ciputat. *jurnal penelitian*. Juli 2016 vol.12, no. 2.
- [6] Fenny, Dalimoenthe ZN., Noormartany, Pranggono E., dan Dewi NS., 2011. Prothombin time, activated partial thromboplastin time, fibrinogen dan d-dimer sebagai

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- prediktor decompensated  
disseminated intravascular  
coagulation disseminated pada sepsis.  
*jurnal penelitian*. Vol. 43 No. 1 Tahun  
2011.
- [7] Fitriahadi E. 2017. Asuhan kehamilan disertai daftar tilik. bahan ajar universitas 'aisyiyah Yogyakarta. Sleman Yogyakarta 2017.
- [8] Gandasoebrata R. 2013. Penuntun laboratorium klinis. edisi 15. dian rakyat. Jakarta.
- [9] Gilang. 2017. Panduan pemeriksaan laboratorium hematologi dasar edisi 2. g nugraha - trans info media. Jakarta Timur.
- [10] Hardisari R., dan Supartuti. 2016. Kappa test with platelet rich plasma (prp) and platelet poor plasma (ppp) blood preparation method for examining the value of activated partial tromboplastin time (aptt) and plasma protrombin time (ppt). *Jurnal teknologi kesehatan*. Jurusan analis kesehatan poltekkes Kemenkes Yogyakarta. September 2016 volume 12, nomor 2.
- [11] Kurniasih H. 2017. Perbedaan hasil pemeriksaan glukosa, sgot, dan sgpt, pada sampel serum dan plasma edta. *Tugas akhir*. program studi d-iv analis kesehatan fakultas ilmu kesehatan universitas setia budi. Surakarta.
- [12] Kusharyati IP. 2018. Gambaran hasil pemeriksaan ppt (plasma prothrombin time) pada plasma sitrat yang disimpan pada suhu ruang (25-30°C) selama 0 jam, 2 jam dan 3 jam. *karya tulis ilmiah (kti)* 2018.
- [13] Maharani EA., dan Noviar G. 2018. Imunohematologi dan bank darah. 2018th ed. badan pengembangan dan pemberdayaan sumber daya manusia kesehatan. cetakan pertama, Agustus 2018. Jakarta Selatan.
- [14] Mitayani. 2009. Asuhan keperawatan maternitas. salemba medika Jakarta.
- [15] Misnah, Abdullah AA., Arif M., dan Bahar B. 2012. Pemeriksaan prothrombin time dan activated partial thromboplastin time dengan humaclot va serta sysmex ca 500. indonesia *journal of clinical pathology and medical laboratory*. Juli 2012.
- [16] Mulyawati I., Azam M., Ningrum DNA. 2011. Faktor tindakan persalinan operasi sectio caesarea. *Jurnal kesehatan masyarakat*. universitas negeri Malang. ISSN 1858-1196.
- [17] Nelly, Mansyur A., Ilham JP., 2018. Analisis nilai clothing time, prothrombine time dan activated partial thromboplastine time pada remaja obes. *jurnal penelitian*. Vol. 1 no. 5, Agustus 2018.
- [18] Nurarif AH dan Kusuma H. 2015. Aplikasi asuhan keperawatan berdasarkan diagnosa medis & nanda nic-noc. mediaction. Yogyakarta.
- [19] Notoadmojo S. 2010. Metodologi penelitian kesehatan. 1st ed. 3. Jakarta: rineka cipta.
- [20] Notoatmodjo S. 2018. Metodologi peneitian kesehatan. pt. rineka cipta. Jakarta.
- [21] Rosida A.,. 2016. Pemeriksaan laboratorium penyakit hati. *jurnal internasional* Feb 2016 vol.12, no.1: 126.
- [22] Saifuddin AB. 2010. Ilmu kebidanan, edisi 4. Jakarta: bina pustaka sarwono prawirohardjo.

- [23] Setiabudy R. 1992. Hemostasis dan hemostasis, 2<sup>nd</sup> ed. Jakarta: Balai penerbit fkui.
- [24] Sugiyono. 2014. Metode penelitian pendidikan pendekatan kuantitatif, kualitatif, dan r&d. alfabeta. Bandung.
- [25] Sulistianingsih AR., dan Bantas K. 2018. peluang menggunakan metode sesar pada persalinan di indonesia (analisis data sdki tahun 2017). *jurnal kesehatan reproduksi*. universitas Indonesia. ISSN: 2354-8762 (electronic); ISSN: 2087-703X (print).
- [26] Tanaka C., Wiarghita K., dan Golden N. 2018. Early coagulopathy as risk factor of mortality in abdominal trauma patients in sanglah general hospital period 2015-2016. *dirertory of open access journal. medicina 2018*.
- [27] Umar I., and Sujud RW. 2020. Hemostasis dan disseminated intravascular coagulation (dic). *journal of anaesthesia and pain*. 2020 volume: 1; no.2: 19–32.
- [28] Wahdaniah, dan Tumpuk S. 2017. Hubungan jumlah trombosit dengan nilai prothrombin time dan activated partial thromboplastin time pada pasien persiapan tindakan operasi caesar. *karya tulis ilmiah* 30 November 2017.
- [29] Waryana. 2010. Gizi reproduksi. pustaka rihama. Yogyakarta.
- [30] Yogatama A., dan Budiarti W. 2019. Determinan persalinan sesar wanita tanpa komplikasi kehamilan di indonesia 2017. *jurnal penelitian 2019*.