AISCH 2022
The 3rd Al Insyirah International Scientific Conference on Health

FEASIBILITY TEST ANALYSIS OF THE LABORATORY UNIT OF NURSE STIKES AL INSYIRAH PEKANBARU

[1]Romi Mulyadi, [2]Nur Hadziqoh, [3]Yeni Pertiwi, [4]Vicky Firmansyah

[1,2,3,4,] Electro-medical Engineering Technology Study Program STIKes Al Insyirah
E-mail: romimulyadi@stickes-alinsyirah.ac.id

ABSTRACT
There are many people who know the unit anesthetic device to perform surgery. Anesthesia is an act of relieving pain during the surgical process. Basically the unit anesthesia machine is a device that delivers the safest anesthetic gas during the surgical process. Anesthesia unit is used to dispense safe anesthetic gas or gas mixture into the anesthetic circuit and then inhaled by the patient and remove the remaining gas mixture from the patient. The importance of medical devices that have been implemented by the MK of the Ministry of Health by using testing and calibration. Testing isthe whole action which includes a physical examination and measurement. Calibration isi mplementation activities to determine the correctness of the value of the measurement tool. Anesthesia units are available in the nursing laboratory of STIKes Al Insyirah Pekanbaru. Anesthesia equipment is used for nursing student practice materials. This research will discuss comparison of calibration results and uncertainty analysis on parameter measurement data from Air Force Hospital Roesmin Nurjaminand data on the STIKes Al Insyirah Nurse Laboratoryin order to find out whether the anesthesia equipment in the laboratory is suitable for use or not.
Keywords: Anesthesia unit, Calibration, Laboratory, Nurse

INTRODUCTION

As we know anesthesia is an act of relieving pain during the surgical process [2]. Basically the unit anesthesia machine is a device that delivers the safest anesthetic gas during the surgical process (Analyzer). The function of the anesthesia machine is to deliver anesthetic gases that are safe when inhaled by the patient and remove the remaining gas mixture from the patient [3]. All medical devices are required to test for calibration and maintain the reliability of medical devices both in terms of equipment performance [9].

Testing isoverall action which includes physical examination and measurement of tools [4]. Calibration is implementation activities to determine the correctness of the value of the measurement tool [6]. If the anesthetic device is not calibrated, it will affect the inaccurate oxygen gas flow rate. One way is to periodically test the instrument to calibrate it. (Medical, nd). In the world of health care, Anesthesia units are used to release a safe anesthetic gas or gas mixture into the anesthetic circuit which is then inhaled by the patient and removes the remaining gas mixture from the patient (Setyowuryani, nd). Guarantee and improve instrument reliability, the anesthesia unit calibration will be carried out (Center, nd).

Anesthesia unit equipment is a tool found in the Stikes Al Insyirah Pekanbaru nurse laboratory (Paradise 2019). With the calibration of unit anesthesia equipment to ensure and improve the quality of nurse laboratory facilities, unit anesthesia equipment is used as a nursing student practice tool and the tool can be operated because the unit anesthetic device has been calibrated according to measurement standards [10].

METHODOLOGY

The stages of this research method are shown in the flowchart as follows:

Figure 1. Flowchart of Research Work

In this study, calibration of the anesthesia unit was carried out with the Acoma Brand, Type Pro-Next+s, Serial number 172000715, using parameter measurements from the ministry of health, calibration was carried out on May 30, 2022 at the Tram Lab.

At this stage of research carried out are :

1. Prepare the Anesthesia Unit calibration working method. The method used uses calibration which is areference from the MK of the Ministry of Health.
2. Prepare Work Instructions for Unit Anesthesia calibration. Work Instructions are derivatives of work methods that can make calibration easier.
3. Designing Work sheets according to work method guidelines. Worksheet to record measurement results when performing calibration.
4. Prepare the calibrator along with Anesthesia Unit. The calibrator is in good working order and can be used. Unit Anesthesia Equipment borrowed from the nurse's laboratory.
5. Calibrate the Anesthesia Unit at the oxygen gas flow rate. The stages of the calibration process are carried out by collecting administrative data on the Gas Flow Analyzer and calibration tools, checking temperature and humidity, electrical safety tests, physical and tool functions tests, and performance testing.
6. Perform data processing of calibration results and analyze. Then data processing is carried out by calculating the uncertainty the measurement.
7. Make a report and conclusion of the feasibility of the tool anesthesia unit. The conclusion of this study is a statement that is suitable for use or not suitable for use.

This research is a quantitative research with experimental method. The subject of the study was the unit anesthetic device in the laboratory of Stikes Al Insyirah Nurse Pekanbaru.

The parameters used are as follows:

Gas Flow Analyzer

Figure 1. Gas Flow Analyzer Calibrator IMT medical
(Allkes.com)

Gas flow analyzer is a tool to measure gas flow rate.

At the installation stage, the oxygen gas flow rate calibration is as follows:

1. Turn on the gas flow analyzer
2. Attach the hose connector to the flow anesthesia unit outlet
3. Turn on the anesthesia unit
4. Adjust the oxygen gas flow rate in the anesthesia unit
5. Read the value of the oxygen gas flow rate on the Gas Flow Analyzer then record it on the worksheet

6. Repeat steps two to five times reading to get a tolerance value of 10%

Oxygen Flush Valve

Figure 2. Oxygen flush valve
(VetTech Australia)

Oxygen Flush Valveis to directly relate high pressure oxygen and low pressure to oxygen flow rate.

The steps for installing the oxygen flush valve are as follows:
1. Set the flow meter to position 2 LPM.
2. Then press the flush button on the anesthesia unit
3. Record the flow value displayed on the display
4. Perform a one-time flush measurement on the measurement data.

Electrical safety analyzer

Figure 3.Electrical safety analyzer
(Scientia Pelita)

Electrical safety analyzeris to measure electricity, medical devices can measure voltage, ground resistance, and leakage current.

Thermohygrometer

Figure 4. Thermohygrometer ETP 101 (ZHU-CL)

Thermohygrometeris to measure the temperature and humidity in the room.

Anesthesia Unit

Figure 5. Anesthesia Unit Acoma
(Acoma Medical)

Anesthesia Unit is to deliver anesthetic gases that are safe for inhalation by the patient and remove the remaining gas mixture from the patient.

Calibration Measurement Results and Tool Data Collection

The results of calibration measurements and data collection of unit anesthetics are in seven tables as follows:

1. Data collection tools,
2. Measuring instrument data collection
3. Environmental condition measurement data collection
4. Physical and function test data collection
5. Electrical safety test data collection
6. Data collection of performance measurement results
7. Data collection on uncertainty analysis

Data Collection Tools

Data collection of facilities and tools is a rarityhfirst in doingcalibrationtoolanesthesia unit. The data collection includes the status of the owner, brand of equipment, type, serial number, date of calibration, place of calibration, and calibration officer.

Data Collection Measuring Instruments

Data collection of measuring instruments consisting of brands, models/types and series of tools. There are three measuring units of anesthesia used in this study, namely: GasFlowAanalyzer, Electrical Safety Analyzer (ESA) and Thermohygrometer.

The results of data collection of measuring instruments are in table 2.

Table 2. Data Collection Measuring Instruments

No	Tool's name	Brand	Type	Series
1	Gas Flow Analyzer	*Imt Medical*	PF-300	BA-104085
2	*ONE*	*Mextron*	QA-90	N/A
3	*Thermohygrometer*	*EOSun*	ETP 101	N/A

Environmental Condition Measurement Data Collection

Environmental factors can affect the results of calibration measurements, so that accurate calibration measurement results can be obtained measure by using Thermohygrometer. Thermohygrometer consists of three measurements, namely line voltage, room temperature and room humidity.

Table 3. Data Collection on Environmental Condition Measurement

1. Rated Grid Voltage	:	227.4	Volt
2. Room Temperature	:	27	C
3. Room Humidity	:	60	%

Physical and Functional Test Data Collection

Data collection on the physical test and function of the anesthetic unit consisting of the body and surface of the device, the tool contact box, the supply cable main, switch button andccontrol,screen display and indicator light can function properly.

Table 4. Data Collection on Physical and Functional Tes

No.	Parameter	Examination Limits	Observation
1	Body and surface	Check the glass tube to make sure it is clean, and not cracked. Check the outside of the unit, it is installed properly and there are no traces of liquid or other disturbances	1
2	Toolbox	Check for damage to the AC voltage socket. Move the contact box to ensure safety. Make sure there is a loose bolt or nut in the socket-outlet	1
3	Main supply cable	Check the main supply cable, there is no damage or chipped cable parts	1
4	Knob, switch and control	Before using change control knob, check its position, if it looks out of position using standard check mode. Compare with control position. Return to the initial settings when you are finished using	1
5	Displays and indicators	Check the indicator light and display are working well	1

Check the glass tube to make sure it is clean, and not cracked. Check the outside of the unit, it is installed properly and there are no traces of liquid or other disturbances

Electrical Safety Test Data Collection

Ensure that the electrical safety measurement has no leakage by using five tests, namely resistance isolation, equipment leakage current, Applied leakage current, and protective resistance, withusing a DC voltage source. In accordance with the electrical safety measurements have been determined and meet the safety requirements at the time of testing.

Table 5. Electrical Safety Test

No.	Parameter	Results	
		Measuring	Threshold
1	Insulation resistance	>200 MΩ	2 MΩ
2	Equipment leakage current	12.6 □	500
3	Leakage current of the applied part	11 □	5000
4	Protective earth resistance	341 □	300
5	Using a DC voltage source	N/A	

Data Collection of Unit Anesthesia Performance Measurement Results

Data collection of tool performance measurement resultsan esthesia unit tested based on the stages ongas flow rateuse unitL/Minute. Tests carried out on10 stages gas flow rate starting with measurement1until10 L/Min. Standard reading results has meet the tolerance value set in the MK of the Ministry of Health of ± 10%.

Table 6. Data Collection of Performance Measurement Results

No.	Parameter	Settings on Tool (L/Minute)	Reading Results On Standard (L/Minute)
1	Gas Flow Rate (L/Minute)	1	1.08
2		2	2.18
3		3	3.39
4		4	4.48
5		5	5.71
6		6	6.97
7		7	8.22
8		8	9.36
9		9	10.84
10		10	12.23

Data Collection Uncertainty Analysis ResultsAnesthesia Unit

In the results of the analysis of the uncertainty that has been calculated. The highest uncertainty value is found in thegas flow rate 10 L/Minute that is equal to ±0.151. Score uncertainty no meet the standards set by the MK of the Ministry of Health of ±10%. Then the tool is declared unfit for use and used.

Table 7. Data collection Uncertainty analysis

No.	Parameter	Settings on Tool (L/Minute)	Reading Results On Standard (L/Minute)	Correct (L/Minute)	Uncertainty (U95% , K=2)
1	Gas Flow Rate (L/Minute)	1	1.08	0.09	± 0.053
2		2	2.18	0.14	± 0.069
3		3	3.39	0.33	± 0.068
4		4	4.48	0.46	± 0.072
5		5	5.71	0.66	± 0.113
6		6	6.97	0.93	± 0.081
7		7	8.22	1.14	± 0.084
8		8	9.36	1.33	± 0.113
9		9	10.84	1.81	± 0.145
10		10	12.23	2.08	± 0.151

CONCLUSION

Based on the comparison of calibration results and uncertainty analysis on the measurement parameters of data from Air Force Hospital Roesmin Nurjamin and data from the STIKes Al Insyirah Nursing Laboratory, the results of the final assessment examination not reach the limit set by the MK of the Ministry of Health is 70%, the tool anesthesia unitis declared NOT worthy of use.

SUGGESTION

Based on calibration results and uncertainty analysisnot reachset limit improvements can be made to the unit anesthetic parameters and recalibration.

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