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FEASIBILITY TEST OF BEDSIDE MONITOR TOOL LABORATORY NURSE STIKES AL INSYIRAH PEKANBARU

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ABSTRACT

Bedside Monitorsis a tool used to monitor the patient's vital signs in the form of heart rate, pulse, blood pressure, temperature, and the shape of the heart pulse continuously.Apart from being used in hospitals, this tool is also used in electromedical laboratories as a tool for clinical practice for electromedical students. All medical devices must be calibrated periodically. In this study, we will discuss how to calibrate the bedside monitor device with the aim of knowing whether the bedside monitor device in the laboratory is suitable for use or not. The research was carried out using work methods set by the ministry of health including physical examination and function of the equipment, electrical safety and measurement of the performance of the device using the suction power parameter. The results showed that the results of the physical inspection and tool function were 10%, electrical safety checks were 30% and performance measurements of NIBP, SPO2,

Keywords: Bedside Monitor, Calibration, SPO2, NIBP

INTRODUCTION

Technology is a collection of tools, rules and procedures which are the application of scientific knowledge to a particular job under conditions that allow repetition [7]. Technology plays a very important role in the world of health, one of which is in the electromedical field [3]. Technological capabilities can guarantee patient safety, patient safety and minimize accidents in the use of tools [2].

To maintain the performance of medical devices both in terms of performance and function of the equipment, all medical devices are required to calibrate regularly [5]. calibration is the activity of determining the truth value and checking and adjusting the accuracy of measuring instruments with national standards Sulistyowati 2017) The measuring instrument must also be calibrated so that the value is according to the standard [6].

Calibration is a series that establishes a relationship between the value indicated by a measuring instrument or measuring system, or the value represented by a measuring material with known values related to the quantity measured in a certain position (ISO/IEC Guid 17025:2005)). The lack of knowledge of health workers regarding calibration is causing problems in Indonesia today (Fadilla 2021).

In addition, various health agencies do not yet have a computerized system to check equipment that is a priority for calibration (Intern 2021). even though the calibration of medical devices is needed to ensure safety when treating patients [10]. By ensuring the quality of this tool will improve patient safety. To overcome this, health workers and prospective health workers must be able to guarantee the quality of the equipment by calibrating it. As for the way to overcome this, do socialization about tool calibration in the world of work and in universities so that in the future the quality of medical devices can be guaranteed bedside monitor device is a tool in the electromedical laboratory of Stikes AL Insyirah Pekanbaru (Uland from 2014). in the medical world a bedside monitor is used to monitor the vital condition of the patient (Suheriono, 2016)In the electromedical laboratory, this tool is used as a practical tool for students and to maintain the quality of the tool, a bedside monitor is calibrated [1].

METHOD

The stages of research conducted are :

a. Prepare a work method for bedside monitor calibration. The method used is a reference from the ministry of health.
b. Prepare calibration Work Instructions, abbreviated as IK, this IK is a work derivative of work methods that are made simpler to make it easier to carry out calibration.
c. Make worksheets according to work method guidelines. The worksheet is used to record the results of measurements when performing calibration.
d. Prepare a calibrator tool along with a bedside monitor device. Preparation of the calibrator tool is done by looking at the calibration label on the calibrator and testing whether the tool is functioning properly. Next, make sure the bedside monitor is in good condition
e. Perform bedside monitor calibration. The calibration process is carried out by collecting administrative data for calibrator and calibration tools, carrying out temperature and environmental checks, electrical safety tests, physical tests and tool functions, and performance testing.
f. Perform calibration results data processing. After conducting performance testing, data processing is carried out by calculating the uncertainty of the measurement
g. Make reports and conclusions on the quality of bedside monitoring devices. The conclusion of this study is the statement that the tool is suitable for use or not suitable for use.

This research is a quantitative research with experimental method. The research subject was a bedside monitor device in the Stikes Al Insyirah Pekanbaru electromedical laboratory. The research was conducted on May 30 2022 at the Stikes Al Insyirah Pekanbaru Electromedical calibration laboratory.

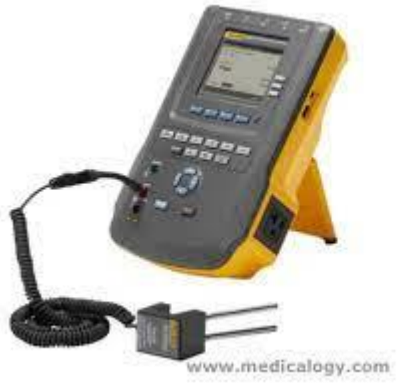

Figure 1. Electrical Calibrator (medicalology)

In figure 1 is a tool that functions to measure electricity so that medical equipment is not damaged such as normal leakage current, alternating current leakage resistance and so on

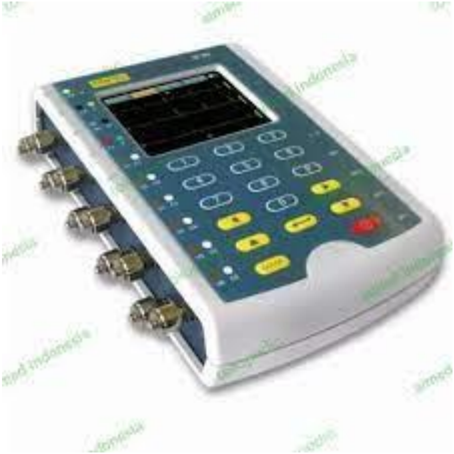

Figure 2. Ecg Simulator Calibrator (contec)

In figure 2 is an ecg calibrator tool that functions to measure the patient's heart rate, how to use this tool connect the pin from the ecg bedside monitor to the ecg simulator pin, after that do a suitability test with the numbers set in the ecg simulator and the numbers on the bedside monitor. these figures will later enter into data processing and uncertainty

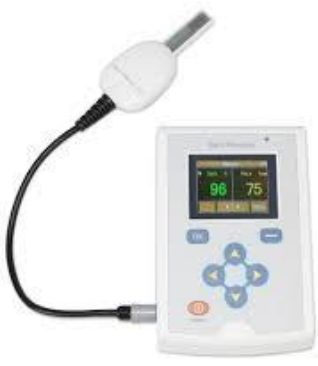

Figure 3. Spo2 Simulator (contec)

Figure 3 is a spo2 calibrator (oxygen saturation) tool. How to use the spo2 cable on the bedside monitor, connect it to the spo2 simulator cable, then set it.

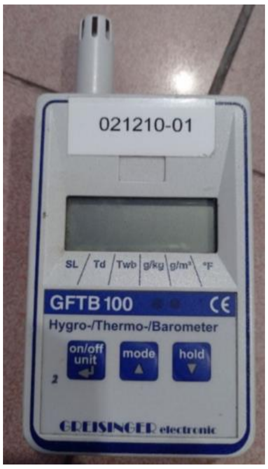

Figure 4. Thermohygrometer

In figure 4 is a tool that functions to measure temperature, temperature and humidity in a room,

Figure 5. Nibp simulator (ms200nibp)

in figure 5 is a Nibp calibrator tool that functions to measure blood pressure in patients, how to use the tool, namely the nibp cable from the bedside monitor is connected to the nibp simulator and then settings are carried out, the value obtained will enter data processing and uncertainty

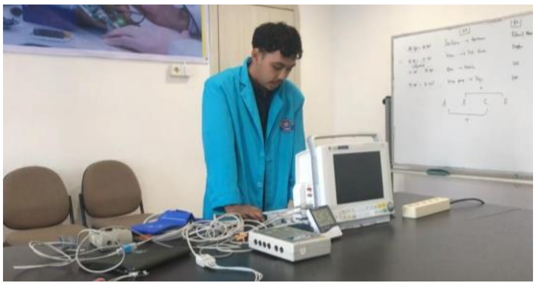

Figure 6. Performance measurement of the bedside monitor device

Figure 6 is a measurement of the performance of the bedside monitor with type 5 parameters

RESULTS AND DISCUSSION

The data from the calibration of the suction pump tool is divided into 7 tables, namely, data on facilities and equipment, data on measuring instruments used, measurements of environmental conditions, physical test data and function of bedside monitor devices, electrical safety tests of bedside monitor devices, performance measurements of bedside monitor devices, as well as analysis of uncertainty in measuring tool performance.

Data Collection of Facilities and Tools

Data collection on facilities and equipment is the first step in calibrating the bedside monitor device. Data collection is carried out to ensure that the tools and facilities used are in accordance with applicable procedures and to avoid errors in reporting and labeling the status of the equipment. The data includes owner status, equipment brand, type, serial number, date of calibration, place of calibration, room, and calibrator.

Table 1. Facilities and Equipment Data

Name of the owner	AL INSYIRAH STIKES
Brand	GE
Model/Type	B2OI
No. Series	SMA18270020HA
Calibration Date	May 30, 2022
Calibration Place	TREM labs
Room	Calibration
Calibration Officer	M nur puja kesuma

Measuring tool used

The data collection of measuring instruments used includes the brand, type and series of tools. There are 4 measuring tools used in this study, namely: ecg simulator, thermohygrometer, spo2 simulator and nibp simulator. The data collection results are in table 2.

Table 2. Measuring Instrument Data

No	Tool's name	Brand	Type	serial no
1	ecg simulator	flukes		
2	thermohygrometer	greisinger	GFTB100	
3	spo2 simulator	flukes	INDEX 2	
4	nibp simulator	flukes		
5	ONE	flukes	ESA615	

Results of Measurement of Environmental Conditions :

Environmental conditions were measured using a Thermohygrometer. Measurements include measured line voltage, room temperature and humidity. Based on table 3, the measured mains voltage is 108.3 volts, while based on the reference method of the Ministry of Health, the mains voltage must be 220 V ± 10%. Likewise, the room temperature must be 25 °C ± 5°C and humidity 55 % RH ± 5%. When compared with the data obtained in table 3, environmental conditions do not meet the requirements for calibration data collection and this will certainly affect the quality of the performance measurement data of the bedside monitor device.

Table 3. Measurement of environmental conditions

1. Rated Mains Voltage	:	108.3	Volt
2. Room temperature	:	27,8	˚C
3. Humidity	:	60,8	%

Physical and functional test results for bedside monitors

Based on table 4 the physical and functional tests of the tool which includes the body and surface of the tool, the tool contact box, the main power supply cable, safety fuses, switch and control buttons, tubes and hoses after observations are functioning properly.

Table 4. Physical Test and Tool Functions

No.	Parameter	Examination Limits	Observation
1	body and surface	Check the exterior and physical cleanliness condition thoroughly, the enclosure is intact, the mercury cylinder has no cracks, is securely attached to one another and there are no signs of being hit by liquid or other disturbances. Make sure there is no physical damage and the sphygmomanometer is in a place where it should be used	1
2	Tool contact box	Check if there is interference in the contact box (AC-Power). Move the socket around to make sure it's secure. Shake the ignition box to make sure there are no loose bolts or nuts.	1
3	Main supply cable	Check the cable, whether there is visible damage or peeling insulation parts.	1
4	Safety fuse	Check the fuse located on the outside of the circuit, whether the resistance value and type are in accordance with the specifications written on the device. The safety fuse must be in good working order.	1
5	Buttons, switches and controls	Before using/changing control knobs, check the position, if it appears to be out of position (check using standard check mode). Compare with control position. Remember these settings and don't forget to return to the initial position when you have finished using the tool.	1
6	Tubes and hoses	Check the condition of the tube and hose, make sure they are not cracked, bent or dirty.	1

Electrical Safety Test Results :

Electrical safety measurement is divided into 6 parameters, namely the value of the normal leakage current with grounding and without grounding, the reverse leakage current with grounding and without grounding, the leakage current on the applied part, the resistance value of the earth wire. All parameter measurement results have met the existing requirements.

Table 5. Electrical Safety Test

No	Parameter	Results	
		Measuring	Threshold
1	Leakage current in normal polarity enclosure with earth	MΩ	≥ 100 µA
2	Leakage current in normal polarity enclosures without earthing	µA	≤ 500 µA
3	Leakage current in the enclosure reverse polarity with earth	µA	≤ 100 µA
4	Leakage current in reverse polarity enclosure without earthing	µA	≤ 10 µA
5	Leakage current in the applied part to all electrodes of normal polarity with earth	µA	≤ 500 µA
6	the resistance value of the earth wire	MΩ	≥ 50MΩ

Bedside Tool Performance Measurement Results :

The results of measuring the performance of the bedside monitor device were tested based on the parameters of heart rate frequency (BPM), O2 concentration, standard set of pressure 1-6 (mmhg). The test was carried out with 6 repetitions. The standard reading results are shown in the table and still meet the tolerances set by the Ministry of Health's work methods.

Table 6. ECG Performance Measurement Results

No	Parameter	Default Setting(bpm)	Instrument Readings
1		30	30
2		60	60
3	frequency heart rate (BPM)	90	90
4		120	120
5		180	180
6		240	240

Table 7. Spo2 Performance Measurement Results

No	Parameter	Default Setting(%)	Reading Result on Tool(%)
1		90	92
2		95	96
3	O2 concentration (%)	97	98
4		98	99
5		99	100
6		100	100

Table 8. NIBP Performance Measurement Results

No	Parameter	Condition	Default Setting (mmhg)	Instrument Reading (mmhg)
1	Standard set of pressure 1 (mmhg)	Systole Mean diastole	60 40 30	60 38 31
2	Standard set of pressure 1 (mmhg)	Systole Mean diastole	80 53 40	80 52 40
3	Standard set of pressure 1 (mmhg)	Systole Mean diastole	100 73 60	100 72 61
4	Standard set of pressure 1 (mmhg)	Systole Mean diastole	120 93 80	119 92 81
5	Standard set of pressure 1 (mmhg)	Systole Mean diastole	140 113 100	139 112 100
6	Standard set of pressure 1 (mmhg)	Systole Mean diastole	180 153 140	179 152 140

Results Uncertainty analysis in measuring bedside monitors.

The measurement uncertainty results that have been calculated are presented in table 9,10,11 (ECG, SPO2, NIBP). This value still meets the predetermined tolerance of ±10%.

Table 9. Uncertainty Analysis of ECG Measurements

No.	Parameter	Settings on Standard (BPM)	Reading Results on Tools (BPM)	Correct (BPM)	Uncertainty (U95 % , K=2)
1	frequency heart rate (BPM)	30	30	0	± 0.8
2		60	60	0	± 0.8
3		90	90	0	± 0.8
4		120	120	0	± 0.8
5		180	180	0	± 0.8
6		240	240	0	± 0.8

In the table above, the uncertainty number is obtained from 6x repetitions, namely 0.8 starting from measurements 30, 60, 90, 120, 180, and 240 with a correction value of 0

Table 10. Uncertainty Analysis of Spo2 Measurement

No	Parameter	Default Setting (%)	Result of Reading on Tool (%)	Correct (%)	Uncertainty (U95 % , K=2)
1		90	92	2	±0.8
2		95	96	1	±0.8
3	O2 concentration(%)	97	98	1	±0.8
4		98	99	1	±0.8
5		99	100	1	±0.8
6		100	100	0	±0.8

From the table above, it is obtained an uncertainty of 0.8 from 6x repetitions with tested values of 90, 95, 97, 98, 99, 100 with corrected values of 2, 1, 1, 1, 1, 0

Table 11. Nibp Measurement Uncertainty Analysis

No	Parameter	Condition	Default Setting (mmhg)	Instrument Readings	Correct (mmhg)	Uncertainty (U95 % , K=2)
1	Standard se of pressure 1 (mmhg)	systole mean diastole	60 40 30	60 38 31	0 -2 1	±0.8 ±0.8 ±0.8
2	Standard se of pressure 1 (mmhg)	systole mean diastole	80 53 40	80 52 40	0 -1 0	±0.8 ±0.8 ±0.8
3	Standard se of pressure 1 (mmhg)	systole mean diastole	100 73 60	100 72 61	0 -1 1	±0.8 ±0.8 ±0.8

4	Standard se of pressure 1 (mmhg)	systole mean diastole	120 93 80	119 92 81	-1 -1 1	±0.8 ±0.8 ±0.8
5	Standard se of pressure 1 (mmhg)	systole mean diastole	140 113 100	139 112 100	-1 -1 0	±0.8 ±0.8 ±0.8
6	Standard se of pressure 1 (mmhg)	systole mean diastole	180 153 140	179 152 140	-1 -1 0	±0.8 ±0.8 ±0.8

from the table above is the uncertainty value with 6x repetitions, while the uncertainty number is 0.8

CONCLUSION

From the results of the physical and functional inspection, a contribution value of 10% was obtained, the results of the electrical safety test were 30% and the performance test of the equipment was 50% so that the total score of the results was 90%. Because the final assessment score exceeded the set limit of 70%, the bedside monitor was declared USERABLE.

SUGGESTION

Realizing that my journal writing is still not perfect for readers, I really need criticism and suggestions so that in the future it can be even better

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