

**Standard Operating Procedure (SOP) for the use of the 2.0
 Autopulse[®] Mechanical Chest Compression System
 on the Coronary Care Unit/Cardiac Cath Labs**

<https://www.zoll.com/medical-products/product-manuals/?pid=9497>

CONTROLLED DOCUMENT

CATEGORY:	Procedural Document
CLASSIFICATION:	Clinical
PURPOSE	The purpose of this SOP is to provide guidance to clinical staff in the management of patients suitable for Autopulse [®] mechanical chest compressions specifically on the Coronary Care Unit (CCU) and Cardiac Cath Labs
Controlled Document Number:	CG310
Version Number:	1
Controlled Document Sponsor:	Associate Director of Nursing, Division B
Controlled Document Lead:	Senior Sister, Lead Nurse Coronary Care Unit
Approved By:	Associate Director of Nursing, Division B Medical Director, Division B Matron, Cardiology Clinical Service Lead, Cardiology
On:	August 2018
Review Date:	August 2021
Distribution:	
<ul style="list-style-type: none"> • Essential Reading for: 	All clinical staff, who are involved in the management of patients on CCU and Cath Labs who require Autopulse [®] mechanical chest compressions
<ul style="list-style-type: none"> • Information for: 	All clinical staff involved in the care of patients on CCU and Cardiac Cath Lab

1.0 Introduction

This document explains how the Autopulse® mechanical chest compression machine must be used in the Coronary Care Unit (CCU) and Cardiac Cath Labs. It has been specifically written with reference to the current equipment in use within Coronary Care and Cardiac Cath labs only.

2.0 Autopulse® Zoll - Mechanical Chest Compressions

The Autopulse® is a non-invasive, transcutaneous cardiac support pump developed by Zoll International. It is used during cardiac arrest as a mechanical cardiac compression device.

3.0 Use of the Autopulse Mechanical Chest Compression Machine

3.1 Rationale for use

For many years research has shown that when performed efficiently and well, cardiac compression performed manually will only provide about 10-20% of normal blood flow to the coronary arteries and about 30-40% of blood flow to the brain (Kern et al, 2000; Ornator et al, 2005). It has been found that near normal coronary artery and cerebral artery blood flow can be delivered within 3 compressions from the Autopulse® (Ikeno et al, 2006; Sandroni et al, 2007). The use of a mechanical device ensures consistency in compression by avoiding compression fatigue and poor performance during manual compressions. It allows also for a member of staff to be free to undertake other tasks (Halperin et al, 2004). Some trials appear to have shown that the Autopulse® improves the chances of return of spontaneous circulation (ROSC) (Spiro et al, 2015) and also survival to discharge neurologically intact (Timmerman et al, 2004) – though this is not supported by all studies.

The Autopulse® is not part of the hospital life support (HLS), intermediate life support (ILS) or advanced life support (ALS) algorithm or part of the Trust resuscitation guidelines therefore does not routinely replace manual chest compressions in any other ward or unit within the trust.

3.2 Indications for use

The Autopulse® must only be used on patients who:

- Are aged over 18 years
- Are ≤136kg in weight
- Have chest circumference range 76cm – 130cm

All staff using the Autopulse® must be trained and assessed as competent in its use. Training must be completed yearly to remain competent.

3.3 Using the Autopulse®

3.3.1 The Autopulse® is a board which lies underneath the patient. It has a band with two arms that comes up over the patient's bare chest. This band is called a 'lifeband' and is for single patient use only. The system is powered by battery, inserted into the board.

3.3.2 The Autopulse® must be switched on prior to deployment to ensure the machine is correctly calibrated. Ensure the patient is aligned correctly (please refer to section 3.7) and that the life band is perpendicular to the patient's chest.

3.3.3 Once in place and secured with Velcro, the life band must be pulled upwards to its maximum length. This allows the device to make a full assessment of the individual patient.

3.3.4 Press the 'start ' button and the life band will start to shorten, measuring the girth of the patient's chest and assessing the amount of pressure required to achieve good compression.

3.3.5 The compressions are circumferential in nature and will start automatically at a ratio of 30:2. There is a facility, once a definitive airway is established and secured, where compressions can be changed to continuous mode.

3.3.6 There is a timer on the device that measures the duration of use. At the 2 minute rhythm and pulse check assessment, press the stop button.

3.3.7 If a shock is required during the resuscitation, the life band can be placed over defibrillator pads. It is recommended the Autopulse® be paused during defibrillation but should not be turned off unless indicated otherwise.

3.3.8 If no shock is required, restart the Autopulse® and continue with the HLS/ILS or ALS algorithm.

3.3.9 During the 2 minute rhythm check, the Autopulse® user should complete a "**Stop A Moment**" assessment (please refer to section 5.0) to ensure the device is still positioned correctly and safely.

3.4 Contraindications to use

The Autopulse® must not be used on:

- Trauma patients
- Patients who have had open chest surgery
- Patients who are 18 years old or under
- Patients at risk of bleeding
- Patients exceeding machine parameters i.e. too obese

3.5 Potential adverse events

Caution should be taken when mechanically ventilating patients in conjunction with the Autopulse due to opposing positive pressures. This may introduce the risk of;

- Ventilation failure due to increased downward pressure from the Autopulse
- Autopulse failure due to increased upward pressure from the ventilator.
- Intra-thoracic haemorrhaging from opposing high pressures.

Where the combination of mechanical ventilation and Auto pulse effect cardio-pulmonary resuscitation, the senior Cardiologist and Senior Anesthetist will action plan together. Manual inflation and / or manual chest compressions may be necessary to optimize patient best outcomes.

3.6 Life Band Installation and Removal

3.6.1 To install the life band, insert the clip into the motor. Pull the band up completely to ensure secure installation. Align the yellow section of the life band panel against the Autopulse[®] and push the panel down to close the catch. Lastly, close the locks located on each side of the Autopulse[®] platform.

3.6.2 To remove the life band from the Autopulse[®], release the two locks located on each side of the life band panel and free the clasps highlighted in yellow. To free the life band from the motor, unwind the band to completion until the release catch is facing upwards. Press the white catch inwards and remove the band completely.

3.6.3 Do not cut the life band from the motor. This can cause the motor to lock without being reset to neutral. This will cause delay in emergency usage as the motor will need to be reset manually by the link nurses.

3.7 Correct Patient Positioning

3.7.1 In order to position the patient on the Autopulse[®], two trained staff are required to lift the Autopulse[®] and two trained staff are required to lift the patient. Refer to Trust Manual Handling Policy and Procedures and for manual handling in Cath Labs, Appendix 1. The patient should be lifted to a sitting position in unison with the platform being lifted. The platform will then be placed on the bed, and the patient lay back down on top of the Autopulse[®] platform.

3.7.2 The life band should be fitted under each arm and positioned level with the patient's armpit line (mid axilla). Failure to properly position the Life Band

may cause injury to the patient. The band can be placed over mammary tissue.

3.7.3 Failure to properly position a patient, both vertically and laterally with respect to the Autopulse® Platform, may cause injury to the patient.

3.7.4 Ensure the life band is **NOT** twisted. This will lead to **MACHINE FAILURE**.

3.7.5 Do not strap across, or otherwise constrain, the LifeBand. Constraining the movement of the bands can damage or break the LifeBand.

3.7.6 Ensure life band is placed on chest for compressions and not abdomen (please refer to 6.2 training).

4.0 Special Considerations

4.1 There is a maximum weight of 136kg and chest circumference of 53 inches for the Autopulse® board.

4.2 In obese patient's Zoll advises that if the life band is big enough to close around the chest then it can be used. To enable getting the patient onto the board, it is recommended that the sit up function on the electric bed is used as opposed to lifting the patient, so that the patient is only leant forward for a short time. This may result in a short delay in getting the board in place and initiating cardiopulmonary resuscitation (CPR) but will protect the staff allocated to lift the patient.

4.3 In patients with abnormal pulmonary pathophysiology (E.g. COPD or pulmonary oedema), the Autopulse® will recognize resistance when attempting to compress. This can cause the device to stop of 3-5 compressions. If after all troubleshooting avenues have been explored, resume manual chest compressions. Do not delay in providing effective CPR.

4.4 Use of the Autopulse® in this situation is the decision of the cardiac arrest team leader. It is beneficial to query the potential requirement of Autopulse® during the catheter laboratory extended safety checklist with the team pre procedure under 'specific risks or equipment requirements identified', to avoid queries in an emergency situation.

5 Stop a Moment

A misplaced life band or incorrect positioning would cause the Autopulse to malfunction, leading to fatal complications such as organ rupture.

'Stop a Moment' is the motion of pausing manual compressions to assess the patient's position on the Autopulse® before starting mechanical compressions. Optimal opportunity to perform this check would be before starting the

Autopulse and then at every subsequent pause in compressions, for a rhythm check. This check should last no more than 5 seconds.

If the position of the Autopulse is incorrect, the team should resume manual chest compressions until the device is repositioned correctly and can be restarted.

6.0 Patient safety and complications

In order to ensure patient safety, it is vital that all staff using the Autopulse[®] have been trained and assessed as competent to use it (see section 11).

Zoll have previously reported serious patient injury from unsafe use of the Autopulse[®] by untrained personnel.

- The lifeband must be in the appropriate place on the patient, to avoid complications such as splenic rupture
- The patient must be effectively aligned on the board to avoid deep tissue abrasion
- Use of the Autopulse[®] must be appropriate for the patient to avoid complications such as loss of circulatory volume if the patient is at high risk of bleeding.

Operating the Autopulse[®] on a patient for extended periods of time may result in minor skin irritation.

7.0 Troubleshooting

7.1 Life band becomes jammed

In the process of putting the Autopulse[®] in place, it is possible that the life band may become 'jammed'. This can happen when the arms of the life band have become twisted around the rotating chamber of the device. If the arms of the life band are then connected without a twist being rectified, the life band will jam and compressions will stop.

To avoid this problem – take a few seconds to manually check that each arm of the life band is straight and not twisted before starting the device.

7.2 Failure of life band

If the life band is damaged in any way, the device may fail.

To avoid this problem and to avoid potential cross contamination – each life band is single patient use and must be disposed of after use. After the device has been used on a patient and the life band removed, a new life band can be fitted.

If a life band is found to be defective, do not discard but keep on CCU ready to be sent back to Zoll for investigation.

7.3 Life band unable to make full assessment

In order to make a full assessment of chest girth and the power of compression required, once the two arms of the life band are stuck together, via the Velcro, the whole life band must be fully extended by pulling it upwards. Failure to do this means that the device will not start compressions.

When starting with a new patient and life band, the arms will already be fully extended. If compressions have been paused for a long period of time, and needs to be restarted; the Autopulse display may ask you to re-extend the life band. This is also the case when replacing the battery at the device will restart and believe the current patient is in fact a new case.

To avoid this problem - once both arms of the life band are attached to each other, gently pull the life band upwards until fully extended.

7.4 Battery Failure

The device may fail to work due to loss of power, if the battery in the device is not changed daily or after every use. There is no way to power this device unless by battery.

To avoid this problem – ensure daily and annual checking of the battery.

7.5 Overheating

The Autopulse is fitted with 2 cooling vents on the back and left hand side of the board to prevent the motor from becoming overheated. It is important these vents are left unobstructed.

To avoid this happening, when the patient is lifted from the bed and the Autopulse[®] is inserted, it is important to check all sheets and blankets are removed or pushed well below the base of the board so not to cover these vents and cause the motor to overheat.

Should the Autopulse become overheated, the motor may switch off with no warning and will not turn back on until it has fully cooled. In this situation, manual compressions must be commenced immediately to avoid break in CPR.

8.0 Batteries

CCU has three lithium batteries for the Autopulse®. One must always be in the Autopulse® while the other two remain in the charger at the nursing station. At the front of the charging unit, there is a system of lights which show whether a battery is charged or charging. The full charging time for a battery is 60 minutes. A fully charged battery will deliver a minimum of 30 minutes of compressions (battery life while in use 30-40 minutes).

Batteries are changed daily and after every use. There is a daily checking procedure in place.

Once a month, each battery needs to undergo a test cycle. This is where the battery is fully drained and then recharged. This process takes 12 hours and is done to preserve the life of the battery (see Appendix 6).

9 Maintenance

9.1 Cleaning

The Autopulse® must be cleaned daily during checking and between patient use, using Trust approved Clinell universal wipes (green). Please refer to Trust Infection Prevention and Control Policy and Procedures.

9.2 Daily and annual checking of the Autopulse®

The Autopulse® is always kept in front of the nursing station on CCU and must be checked daily every morning by a competent nurse.

The daily check consists of:

- checking all batteries (1 x in Autopulse® 2 x in charger on nursing station) are charged full (green),
- rotating the battery that has been in the Autopulse®
- ensuring the Autopulse® is clean and free of contaminant/body fluid
- ensuring the lifeband is fully extended and has not shrunk
- turning the Autopulse® 'on' and checking that there are no error messages on screen then turning 'off'
- Signing the daily checking sheet on the Autopulse® trolley (appendix 6).

The Autopulse® is sent back to Zoll once a year for its annual check up to maintain its extended warranty. During this time, Zoll replace the Autopulse® unit with one of their loan ones.

This standard of practice also applies to the Zoll loan Autopulse®.

9.3 Life Bands

Life bands are single use and so are disposable.

A life band should always be inserted into the device and checked for correct installation by turning the device on. If an error is shown on the display, the band will need reinstalling.

If any life bands are found to be faulty they are not to be discarded but instead kept on CCU to be sent back to Zoll for further investigation and potentially replacement.

10 Ongoing care

Complete all resuscitation documentation as per UHB trust resuscitation policy and continue with appropriate resuscitation algorithm (HLS/ILS/ALS). The use of the Autopulse[®] is currently outside of the trust resuscitation policy.

11 Training and Competence

All staff using the Autopulse[®] must have been trained by a core trainer.

11.1 The training must include:

- Demonstration of how to set up the Autopulse[®] using a mannequin.
- Identify and explain all icons and controls.
- Practical use of the Autopulse[®] using a mannequin and the learner demonstrates safe use of controls.
- Troubleshooting problems.
- Cleaning of the device.
- Changing the batteries, daily checks and monthly test cycles of batteries.
- Changing of the life band; demonstration and then practice.

11.2 Evidence of satisfactory supervised practice must be witnessed by a practitioner who is already competent in use of the Autopulse[®]. (Appendix 2)
The number of supervised practices will reflect the individual's learning needs.

11.3 Staff must then be assessed as competent in use of the Autopulse[®], prior to using it unsupervised. Evidence of competence must be provided (Appendix 3).

11.4 Staff must be re-assessed YEARLY to ensure continued competence and to safeguard patient safety.

12.0 Usage Restrictions

12.1 CCU and Cardiac Cath Labs provide a 24 hour emergency primary service. During these cases access to the Autopulse[®] is paramount. Therefore usage should be restricted to CCU and Cardiac Cath Labs to prevent loss of a vital life support device.

- 12.2 To ensure safe, effective and appropriate use, the Autopulse® must only be operated by trained and competent staff.
- 12.3 Removal of CCU staff to provide an Autopulse® service to other areas can jeopardize patient safety due to the consequent loss of staff from CCU. Hence the Autopulse® should not be used outside of CCU and Cardiac Cath Labs.
- 12.4 The Autopulse® is NOT part of the Trust Resuscitation Guidelines or Resuscitation Council Algorithm and is not authorized or insured for use outside of CCU and the Cardiac Cath Labs. Hence it should not be sort by other departments or wards.
- 12.5 In the event where the Autopulse® is used elsewhere in the trust, an incident report should be generated to monitor and explore cases where this policy has not been adhered to.

13.0 Monitoring and Audit

There will be an ongoing audit of use with the Autopulse® within the Coronary Care Unit and Cardiac Cath Labs. Collected data will be reviewed monthly by the Lead Consultant Cardiologist and the Senior Sister/Charge Nurse, Coronary Care Unit, and findings will be reported at Consultant Meetings. All audits must be logged with the Risk and Compliance Unit.

Any untoward incidents and near misses must be reported via the Trust incident reporting system, and where required escalated to the appropriate management team. In addition, the Risk and Compliance Unit must be notified by telephone of any Serious Incidents (SI). (Please refer to appendix 4)

11.0 References and Bibliography

- Halperin HR et al(2004). *Journal of the American College of Cardiology*.44(11):2214-2220.
- Ikeno F et al(2006) *Resuscitation*. 68:109-118.
- Kern K et al(2000). *Bailliere's Clinical Anaesthesiology*. 14(3):591-609.
- Ornator JP et al(2005). *American Heart Association Annual Meeting*.
- Sandroni C et al(2007). *Intensive Care Medicine*. 33: 237-245.
- Spiro JR et al(2015) *International Journal of Cardiology*. 180: 7-14.
- Timerman S et al(2004). *Resuscitation*. 61:273-280.5.

Standard Operating Procedure prepared by:

Eleanor Johnson Staff Nurse, Coronary Care Unit

Jessica Wright
Ruby Kwok

Staff Nurse, Coronary Care Unit
Senior Sister, Coronary Care Unit

Appendix 1

Cardiac Arrest using Autopulse® In Cath Labs

In the event of cardiac arrest in the cath lab the '2222' protocol is followed as normal. The lead interventionist will always remain lead in the overall arrest situation.

A standard Cath Lab procedure will work off a minimum of 6 members of staff consisting of a cardiology consultant, a cardiology registrar, 2 nurses, 1 cardiac physiologist and 1 radiographer.

1. At point of cardiac arrest, the cardiology consultant calls for the Autopulse®. A nurse will then allocate a member of the cath lab team to collect the Autopulse from CCU depending on who is available to leave the lab at that time.
2. A trained Autopulse practitioner must be allocated to take charge of the Autopulse® instruction and should be the only person to adjust its settings. This could be a Nurse or Cardiac Physiologist.
3. The cardiology consultant and registrar will remain sterile, securing any sheaths/ wires as well as securing the patients feet to avoid them slipping down the bed whilst the patient is lifted.
4. 2 practitioners will take position on either side of the patient, ensuring manual chest compressions are started and maintained until the patient is ready to be lifted and Autopulse® positioned correctly!!
5. The third and fourth practitioner will be at the head of the table ready to life the Autopulse. At this point the Autopulse should be powered ON, ready to start as soon as the patient is positioned correctly.
6. The patient is lifted to a 90 degree angle and supported whilst the Autopulse® is positioned **effectively** underneath the patient. The sheet underneath the patient is tucked below the patient's coccyx and the patient is laid down onto the Autopulse® board.
7. 2 trained practitioners will then secure the life band.
8. The named practitioner taking charge of the Autopulse will confirm position and alignment, then immediately start the Autopulse® at a ratio of 30:2.
9. Whilst on the ratio of 30:2 a nurse will remain at the head of patient ready to provide ventilations.
10. The practitioner in charge of the Autopulse® will remain next to the Autopulse® stating arrest time, cycles completed, checking battery level, and

ready to instruct further (i.e. if a battery change is needed, if it is near rhythm check time, if manual chest compressions need to be restarted).

11. Cardiology consultant will instruct when to stop compressions for rhythm check. If shock is required, Autopulse should be turned off. When Autopulse is powered back ON, lifeband will need to be reset before restarting.
12. When resus team arrive adjust accordingly and if a permanent airway is achieved the Autopulse® cycle can be changed to 'continuous'
13. Autopulse® cycles continue until the arrest lead instructs to stop.

If intervention is to continue the Autopulse® can remain in position but turned off. Radiographers have a copy in each lab of Zoll's recommended angiography angles with Autopulse® insitu.

After Autopulse® is no longer needed it is the responsibility any trained practitioner to clean the equipment, dispose of the old Lifeband and replace with a new Lifeband. When returned to CCU the battery should be replaced and the used battery should be put to charge. The use of the Autopulse should then be documented on the Audit attached to the trolley.

Appendix 2

AUTOPULSE® MECHANICAL CHEST COMPRESSION COMPETENCIES

EVIDENCE OF SUPERVISED PRACTICE

To become a competent practitioner, it is the responsibility of each registered nurse to undertake supervised practice in order to become competent to care for patients requiring mechanical chest compressions on Coronary Care Unit and Cardiac Cath labs.

Name of registered nurse:

DATE	DETAILS OF PROCEDURE	SATISFACTORY STANDARD MET	COMMENTS	PRINT NAME, DESIGNATION SIGNATURE &
		Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		
		Yes / No		

Appendix 3

Assessment of competence in the use of the Autopulse® by registered and unregistered nurses.

End competence: to safely use the Autopulse®, a non-invasive cardiac compression device

Name of practitioner: Band:

Name of assessor:

<u>Element of competence to be achieved</u>	<u>Assessor's Signature</u>	<u>Practitioner's signature</u>	<u>Date</u>
Provide evidence of current HLS training update			
Provide evidence of training in the use of the Autopulse® (appendix 4)			
Describe indications for use of Autopulse®			
Describe contraindications for use of Autopulse®			
Describe how the Autopulse® works			
Discuss how to prepare the members of the Cardiac Arrest team for the use of the Autopulse®			
Discuss how to prepare the area for the use of the Autopulse®			
Demonstrate on a mannequin how to place the patient on the Autopulse® correctly			
Demonstrate on a mannequin correct positioning of the lifeband			
Demonstrate on a mannequin correct preparation of lifeband for use			
Demonstrate how to switch on and then start the Autopulse®			
Discuss when and demonstrate how the settings on the Autopulse® would be changed from 30:2 to continuous compressions			
Describe the meaning of the text and icons on the Autopulse® screen Discuss any actions that may be required by the practitioner in			

response to one of these icons or texts.			
Describe when the Autopulse® would be paused or stopped and who would make that decision Demonstrate how to pause and stop the Autopulse®			
Describe what documentation is required after the use of the Autopulse®			
Demonstrate correct cleaning of the Autopulse®			
Demonstrate correct changing of the lifeband and discuss when this would occur			
Demonstrate correct changing of the batteries and discuss when this would occur			
Demonstrate the daily checking procedure and discuss what a Test Cycle is and how often this is performed			
Discuss special considerations/troubleshooting/what to do if the Autopulse® is faulty			

I declare that I have expanded my knowledge and skills and undertake to practise with accountability for my decisions and actions.

Signature of Practitioner:.....

Print name:.....

Designation:.....

Date:.....

I declare that I have assessed this practitioner and found her/him to be competent as judged by the above criteria

Signature of Assessor:

Print name:.....

Designation:

Date:.....

Appendix 4



Delivering the best in care

University Hospitals **NHS**
Birmingham
NHS Foundation Trust

ATTENDANCE CERTIFICATE

This is to certify that

.....

Attended

Autopulse® training.

This included :

- Use during cardiac arrest
- How to change the life band
- Troubleshooting
- Battery Management
- Cleaning

At CCU QEHB

On

.....

Assessor's signature:

PRINT.....

Appendix 5

Autopulse[®] Cath Lab Useage

Date	Cath Lab	Patient no.	How long?	CCU nurse	Autopulse [®] ready to go?
<i>e.g 10-02-15</i>	<i>Lab 1</i>	<i>G101010</i>	<i>2300-0100</i>	<i>Adam</i>	<i>Yes</i>

Appendix 6

Year:

ZOLL

Autopulse® & Battery Maintenance and Rotation Record

Month: _____

Day	Battery Autopulse® in	Fully charged?	Initial	Batteries in charger	Initial
Example	1	Y	AS	2 + 3	AS
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					