

## COMPARISON OF TWO METHODS FOR RECORDING FROG'S MYOCARDIOGRAM

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**Background:** Frog's myocardium gives the medical students a clear understanding of the normal sequence of atrial and ventricular contraction and the effect of temperature, sympathetic stimulation and parasympathetic stimulation on frog's heart. The purpose of this study was to compare two methods used for recording of frogs myocardium, namely kymographic method and iWorx data acquisition unit Method, keeping in view the difference between the recordings obtained by two methods and the convenience for the medical students in recording the myocardium by the two methods. **Method:** Frog was dissected and myocardium recorded first with the kymograph and then with the iWorx data acquisition unit. Frog's saline was pored at regular intervals and both kymographic and iWorx readings were taken thrice at an interval of 5 min. **Results:** In the myocardium height of the recording on the y-axis indicates the strength of contraction by the frog heart. The height of myocardium recorded on the kymographic recording at intervals of 5 min each was compared with the height of the myocardium recorded on iWorx data acquisition unit at the same time. Comparison of the results at the same time interval show that iWorx data acquisition unit system reflects the mechanical activity of heart better than the conventional kymographic method. Even when the kymograph show no record of myocardial contractility the iWorx data acquisition unit still show the activity of the myocardium. **Conclusion:** This study shows that iWorx system reflects the mechanical activity in myocardium even when the kymograph cannot record it.

**Key words:** Kymograph, iWorx data acquisition unit, Frog

### INTRODUCTION

To have a clear understanding of the basic physiological processes in human body it is important for the medical students to have ample opportunities to observe and demonstrate these processes on lower animals. In cardiovascular system recording of frog's myocardium gives the students a clear understanding of the normal sequence of atrial and ventricular contraction and the effect of temperature, sympathetic stimulation and parasympathetic stimulation on frog's heart.

Generation and propagation of cardiac impulse in the heart is so sequenced that atria contract before the ventricles. The pacemaker of the heart is the sinoatrial (SA) node, located in the right atrium. An action potential from the SA node travels via gap junctions to adjacent cells in the atria causing the atria to contract. The action potential also spreads to the atrioventricular (AV) node. The action potential moves slowly along the electrical pathway in the AV node, and then travels rapidly along the Bundle of His and Purkinje Fibres to the fibres of the ventricle. The slow transmission of the action potential through the AV node insures that the ventricles contract after the atria. This delay allows the ventricles to fill with blood from the atria before the ventricles contract.

Recording of frog's myocardium and observing effects of various physical and chemical

factors is an important practical in all the medical colleges and universities. Kymograph is used in physiology laboratories for recording myocardium and for studies on nerves and muscle preparations.<sup>1,2</sup> Conventional procedure for recording of myocardium with kymograph is manual/laborious involving replacement of the graph paper on the drum and filling and adjustment of ink-stylus, manual analysis of the results obtained on the graph paper and interference by the tip of recording stylus on the recording paper.<sup>3</sup> Continuous effort to overcome these problem over a period of time has resulted in new kymographs with much better recordings.<sup>4,5</sup> More advancement resulted in combining kymograph with the computer to further improve the recordings of kymograph.<sup>6,7</sup> iWorx data acquisition unit is an independent system to perform all the tasks of kymograph and even much more than these tasks and gives a complete uninterrupted recording of the heart activity and computerized analysing facility.<sup>8</sup> This study compares two methods of recording of frogs myocardium: the conventional recording and the iWorx data acquisition units recording.

### MATERIAL AND METHODS

The experiments of this study were carried out at Army Medical College, Rawalpindi. The procedure was carried out in accordance with the institutional guidelines for the care and use of the laboratory animals.

**Equipment:**

Dissection set, dissection tray and frog’s saline (0.65% NaCl) available at Army Medical College was used. iWorx data acquisition unit AHK214 was used for recording and analysis of the myocardigram.

**Tissue preparation:**

Frog was stunned and pithed and heart was exposed by dissecting the anterior abdominal wall of the frog in the dissection tray. The pectoral girdle was also dissected to fully expose the heart. Clip was tied at the apex and other end was attached to the tip of the ventricle, with a thread.

**Recording of myocardigram with the kymograph:**

The dissection tray with the frog heart fully exposed and tip of the ventricle clipped was brought close to the kymograph. Velocity of the revolving drum of kymograph was set at 10 mm per second. Graph paper was pasted on drum of the kymograph and ink stylus was filled with ink. Thread of the clip was tied to the recording apparatus and the kymograph turned on to record the myocardigram.

**Recording of myocardigram with the iWorx data acquisition unit:**

After recording the myocardigram on the kymograph the dissection tray with the frog’s heart was brought close to the recording unit of iWorx/214. The iWorx/214 unit was connected to the computer and the DIN connector on the cable of the force transducer was plugged into Channel 3 of the iWorx/214 unit. The ‘LabScribe’ icon on the Desktop was clicked and ‘start’ was clicked to record the myocardigram. Recordings were taken at interval of 5 min thrice, first on the kymograph and later on the iWorx data acquisition unit.

**RESULTS**

The recordings of frog’s myocardigram obtained from the kymograph and the iWorx data acquisition unit are shown below as Figure-1 and Figure-2 respectively.

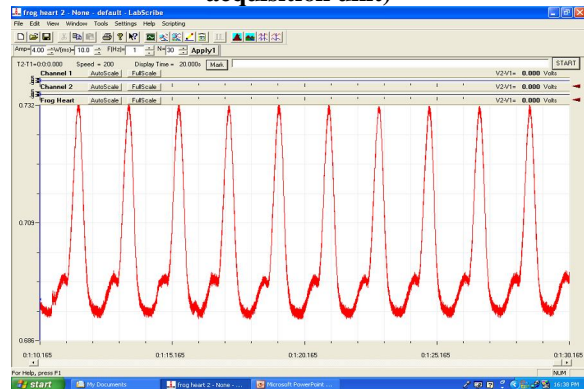
The strength of myocardial contractility reflected by the height of the recording of myocardigram by the two methods is compared in Table-1.

When the kymograph became unable to record any activity of myocardium iWorx data acquisition unit was still recording the activity of myocardium. Recording of myocardigram at end of 10 min is show in the Figure-3 and 4.

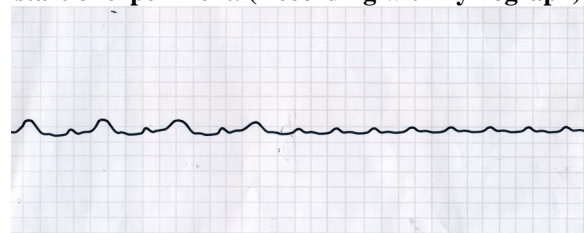
**Table-1: Height of myocardigram recording (Cm) recorded by kymograph and iWorx system.**

Time from start of 1 <sup>st</sup> recording (min)	Height of myocardigram (cm)	
	Kymographic recording	iWorx recording
0	2.0	23.0
5	0.3	7.0
10	0.0	0.6

**Figure-1: Frogs myocardigram recording at start of experiment. (Recording with iWorx data acquisition unit)**



**Figure-2: Frogs myocardigram recording at start of experiment. (Recording with kymograph)**



**DISCUSSION**

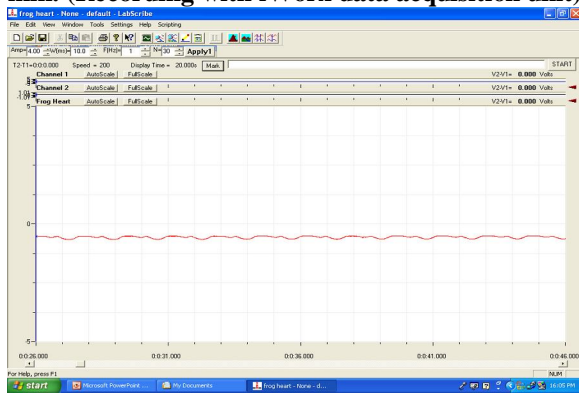
In the present study the difference between the recordings of myocardigram by kymograph and by the iWorx data acquisition unit was compared. The results of the study show that the iWorx data acquisition unit is more sensitive, detects the mechanical activity of myocardium for a longer duration of time and is more reflective of the power of contraction of myocardium.

Kymograph is in use by most of the physiology laboratories of the medical colleges and is an established mean for the recording of myocardial activity by the medical students. But overall rapid transition from the conventional to a more computerized system of education demands that the practical systems must also be upgraded and iWorx data acquisition unit is the solution.

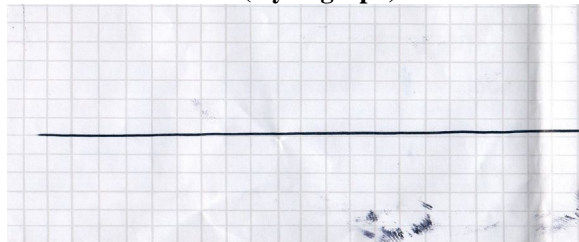
Ongoing efforts by physiologist to improve the activity and sensitivity of kymograph in past has resulted in the evolution of now available kymographs with much improved performance.<sup>5</sup> Pantic VS and Pantic SM in 1996 developed new

improved ink-stylus to reduce the friction of writing pen on the graph and thus added in the ongoing efforts by the physiologist to improve the kymograph.<sup>4</sup> Other physiologist increased the efficacy of kymograph by improving its other accessories. But still the kymograph recordings are not as good reflective of myocardial activity as compared to the recordings obtained from the iWorx data acquisition unit. In addition of its being more sensitive and reflective of the contractility of myocardium iWorx is also more convenient to use and is helpful in recording other physiological activities in laboratory animals<sup>9,10</sup> as well as in the clinical practice.<sup>11,12</sup>

**Figure-3: Frogs myocardigram recording after 10 min. (Recording with iWorx data acquisition unit)**



**Fig-4: Frogs myocardigram recording after 10 min (Kymograph)**



Frequent requirement to change the graph paper, refilling of ink in the stylus and difficulty in recording because of moving away of the stylus from the graph paper on contraction are serious problems faced while recording myocardigram on a kymograph. iWorx system is free from the requirement of graph paper and ink stylus. iWorx data acquisition unit also enables the student for a quick analysis of the recordings by using the inbuilt

computerized analysis. While recording the effect of temperature or drugs on myocardium, using the kymograph, student is required to calculate the number of beats per min and than compare them with the other recordings manually but iWorx data acquisition system completes all the analysis and is much convenient for the analysis and comparisons of different recordings.<sup>13</sup>

To conclude the study has shown that the iWorx data acquisition system records true reflection of the contractility of myocardium even when the kymograph is unable to record. It is also convenient and enables easy analysis of the recordings.

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