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"Hang" and "Crash" in Fault Analysis of Philips HD Series Color Doppler Ultrasound in Summary of Medical Equipment Maintenance Experience

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Abstract: Color doppler ultrasound is an important imaging equipment to examine systemic diseases in hospital.Over the past years, the Philips HD series ultrasound system have attracted great attention for their outstanding imaging ability. This paper introduce the structure principle of HD series ultrasound system,and introduces the difference and different troubleshooting methods when HD color doppler ultrasound system displays' Hang 'and' Crash 'faults.

Keywords: HD Series; Structure Principle; "Hang" and "Crash"; Troubleshooting Methods

1. Instruction

Ultrasound imaging diagnosis is one of the four medical imaging diagnosis techniques in hospitals, because it has the characteristics of non-ionic radiation, non-invasive examination and repeatability examination, it is widely used in clinical practice in hospitals[1,2].At present, the ultrasound equipment most frequently configured in hospitals is B-type ultrasonic examination equipment, referred to as B-ultrasound, which shows the tissue and organ structure of the human body through ultrasonic probe scanning and image algorithm, and can distinguish the substantial, gaseous and liquid structures in the tissue, and is widely used in the examination of organ lesions[3,4]. Color Doppler ultrasound, referred to as color doppler ultrasound, uses the autocorrelation technology to process the doppler signal to form the blood flow signal in the human body, and superposes it on the image signal of B ultrasound in real time, which can display the distribution of blood vessels, the direction and speed of blood flow, abnormal blood flow signals and other rich hemodynamic information[5]. It is used to check all kinds of blood vessels, digestive system, urinary system, gynecology, obstetrics, glands and other systemic diseases.

Philips HD series color doppler ultrasound, including Envisor, HD6, HD7, HD11, HD15 and other different models, covering both high and low end models, has been popular due to its excellent imaging capabilities.Although the HD series color super model is numerous, but its system platform, hardware type and structure principle are basically similar. Therefore, when encountering some fault types, we can learn from each other and use the same ideas to solve the problem.This paper briefly introduces the structure and principle of HD series color doppler ultrasound, and focuses on the analysis of clinical engineers' thinking and troubleshooting methods when we encounter different types of crash faults in color ultrasound maintenance.

2. Fundamentals of HD series color doppler ultrasound

The principle of HD series color doppler ultrasound is basically similar. The system structure is mainly composed of the front part, the back processing part, the display part, the power supply system and other peripherals and accessories. The front part of the system can be referred to as E - Box, which is responsible for the signal transmitting and receiving in the front part of the system, processing the received signal, modulating and demodulating voltage, beam processing and other functions.It includes various ultrasonic probes of different sizes and frequencies, signal acquisition module, beam processing module, etc. The back processing part is mainly composed of image processing module and control module. The control module includes

track ball, touch screen, keyboard, printer and other peripherals, and the display part mainly includes image display. When color doppler ultrasound starts to work, the front part of the system generates synchronized trigger pulse signals, and the signal acquisition module receives ultrasonic signals reflected from human organs and tissues.The beam processing module converts the ultrasonic signals received by the signal acquisition module into high-frequency electrical signals, and the image processing module at the back processing part converts high-frequency electrical signals into video signals to display the human body section on the image display[6-8].

3. Failure summary and analysis

In the classic HD series of Philips color doppler ultrasound, if an error message is detected internally, the system will display "Hang" or "Crash", which is occasionally encountered by doctors in daily use. In fact, although the faults caused by these two phenomena may be the same or similar, they each represent different types of faults, and their causes and maintenance methods are also different.

These two types of failure are distinguished to help doctors and clinical engineers distinguish the nature of the two types of failure, so that they can properly deal with the two types of failure and provide the most appropriate treatment for the failed device in a timely manner.

"Hang" refers to the color doppler ultrasound master server hanging, unresponsive. In fact, due to data and software updates, it is sometimes possible for the system to return to normal after waiting for a period of time. However, in the current fault situation, the system does not respond to input from other terminals such as the main keyboard, touch screen or trackball.

"Crash" occurs when the hardware inside the system detects an error state or a software conflict. When crash occurs, the system starts the system conflict recorder, and a dialog box pops up on the screen, The following information is displayed: The instrument has detected an internal error and is collecting information to help diagnose the problem. The machine can not be used normally, the system forcibly shut down.Doctors can do nothing about the situation, but turn to engineers for help.

When the main server of color doppler ultrasound hangs up and has no response, first of all, we should observe the screen. If the time continues to go, the image also changes with time, but the trackball and keyboard have no response. We might as well continue to wait for a period of time, there is a high probability that the main server is only temporary no response. After waiting some time, the host server may resume the response. This is the simplest and cheapest way to handle it. In another case, the dialog box that appears on the screen may be hidden. For example, when the user customizes a maternity preset condition, if the user enters an invalid parameter or a parameter beyond the upper and lower limits, the system will pop up a dialog box indicating that the input is invalid. If the user clicks somewhere outside the dialog box at this time, the server may hang up and wait for the user to click the "OK" command, resulting in no response from the keyboard and trackball operation. The correct way to do this in this case is to click OK in the dialog box and then re-enter the parameters within the range.

The system Crash or software conflict caused by "Crash" encountered by doctors in use is generally divided into two types. The first type is the breakdown of color doppler ultrasound. In this case, every time the machine is powered on, the system will crash. The same happens when you restart the machine, and the system is not working properly.There is nothing a doctor can do about this situation, so he can only seek help from the maintenance engineers of the manufacturer or hospital. The second type of failure is intermittent. A Crash may occur every few days or a week, but the restart usually works normally.

First of all, for these two types of crash, we need to analyze the cause of crash through the log browser in the system, and the error information can provide important information . For example, the error message "Could not establish communication with E-Box" indicates that the servers of front part and back processing part cannot establish a connection. We need to check the hardware related to communication between the front and back processing boards.

When the system crashes, we can see a blue screen or we can see "Corrupted hard drive" on the screen, which means the hard drive is damaged or crashes.In this case, we can fix the problem by reinstalling the software. Hard drive damage is often

caused by incorrect shutdown.In order to prevent the occurrence of hard disk damage, we must let ultrasound doctors remember common operation habit.The ultrasound doctors need to adhere to the correct switching process every day.They must ensure that the system is completely shut down before disconnecting the power cord. If the voltage is often unstable, engineers may consider installing a UPS or a stabilized power supply to prevent transient voltage from affecting the system.

Secondly, if the ultrasonic machine breaks down,as the ultrasonic application cannot start normally ,we cannot view the error log information in the host system . At this point, we can enter the simulation mode. In the simulation mode, the image only shows the noise of the surrounding environment, but other functions of the system application are normal, so we can enter the system background to check the error log information normally.

Finally, in the event of a system crash, it is possible for the RST self-test system to start even if the ultrasound application cannot start.

It is very meaningful to enter the RST self-check mode. First, if you can enter the RST main interface, it indicates that the PC can run normally. Secondly, if the test interface can be opened normally, it indicates that the communication between PC and e-box is normal. At the same time, the test results are very specific to the fault because of the repeated running of the test.

4. Conclusion

This paper briefly described the system structure and principle of Philips HD series color Doppler ultrasound,mainly introduced the different causes of the breakdown of HD series color Doppler ultrasound and the corresponding solutions.In view of the different Crash situations caused by "hang" and "Crash", it is necessary to analyze them separately and find appropriate treatment methods to avoid taking some detours for granted, so as to solve the fault more quickly and save the maintenance cost of the hospital.

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References

[1] Hu, J, Zhou, ZY, Ran, HL, et al. Diagnosis of liver tumors by multimodal ultrasound imaging.[J]. Medicine (Baltimore), 2020, 99: e21652.

[2] Laghi Franco A, Saad Marina, Shaikh Hameeda, Ultrasound and non-ultrasound imaging techniques in the assessment of diaphragmatic dysfunction.[J] .BMC Pulm Med, 2021, 21: 85.

[3] Lu, HQ, Sun, S, Zhang, XF, [Research on Quality Evaluation System of Ultrasound Diagnostic Equipment Maintenance]. [J].Chinese journal of medical instrumentation, 2019, 43(3): 223-225.

[4] Nielsen MB, Søgaard SB, Bech Andersen S, et al. Highlights of the development in ultrasound during the last 70 years: A historical review. Acta Radiologica. 2021;62(11):1499-1514.

[5] Katamay R, Fleischlin C, Gugleta K et al. Volumetric blood flow measurement in the ophthalmic artery using colour Doppler.[J] .Klin Monbl Augenheilkd, 2009, 226: 249-53.

[6] Goodman MA, Utilizing airborne/structure borne ultrasound for predictive maintenance inspections[C]// Society for Machinery Failure Prevention Technology Meeting. UE Systems, Inc. 14 Hayes Street Elmsford, NY 10523, 2005.

[7] Zhou, Q, Maintenance of ultrasound diagnostic equipment[J]. China Medical Equipment, 2011.

[8] Xiong, Q, Common Faults and Maintenance of Ultrasound Equipment[J]. Mechanical Management and Development, 2016.

1. Innovation Capability Support Plan of Shaanxi Province (2017KCT-36)；

2. Natural Science Special Project of Shaanxi Province(2020SF-035)