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Biomedical Imaging in Animal Health Diagnostics

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SUMMARY

Medical imaging is a rapid evolutionary phenomenon which calls for expert researchers to develop optimised imaging techniques and advanced diagnostic efficacy. This provides the health professionals in-depth knowledge of the inner workings of the person's body as well as the functions of the organs and tissues. The knowledge is often the key to the clinical analysis of the person, situation or the implementation of life saving interventions. Medical imaging technology is constantly evolving and we need knowledgeable, highly skilled practitioners to ensure the care for the patients. Computed tomography, Magnetic Resonance energy, hybrid energy, radiographic imaging are already gone to its advance level of diagnosing the human aliments. Imaging aquatic organisms are not in a level of hype. Studying the aquatic animals shape our understanding of physiology, biochemistry, and biology, and provide models of human disease and normal function. This article depicts the medical imaging so far done with fish as experimental model.

INTRODUCTION

In the developed world, most of us take medical imaging for granted. We have experienced it all our lives. We expect it to be provided and yet, when our doctor gives us a slip to get a scan done, we wonder what it is all about. For most of us, our first imaging experience is one in which we have no memory, an ultrasound examination during our mother's pregnancy. It is used to assess how old we are, how fast we are growing, and if we are likely to be a healthy baby. Based on this examination, doctors make decisions about our health and the health of our mother. Then during our life journey, we have X-rays of our teeth, or CT x-ray for abdominal pain. It may be bone scans for stress fractures or routine mammograms as a screening tool. We may come across the name Magnetic Resonance Imaging in neuroscience and psychology. Can we really see what is going on our mind in MRI scans? All these techniques generate a huge amount of data, which can be an explosion of information. The main challenge is to store and analyse this information. This is where visualization becomes so important from simple two dimensional black and white images to spectacular 3D dynamic colour images you can fly through.

In Human Health Care

Radiography, computed tomography (CT), ultrasound, and endoscopy are all common diagnostic imaging techniques used in mammalian medicine. Advances in medicine over the past few decades have improved health care immensely allowing doctors to more efficiently diagnose and treat disease but doctors are still humans which means they understandably still makes mistakes. There comes the biomedical imaging which utilises the artificial intelligence to get accurate values. There was already the emergence of the biomedical imaging has shown its potential in investigating the molecular mechanisms of drug delivery by the broad use of high resolution bimolecular NMR. The unimaginable progress in computer hardware and new mathematical algorithms allowed complex processing schemes such as neural networks, compressed sensing, tensor decomposition etc into a simpler applications. The beauty of science is the imaging of brain vasculature down to microscopic scale which seems to be non-invasive. This has been performed by the Physics for Medicine Lab.

In Aquatic Animal Health

There were few research and reports on medical imaging performed in fish which states that slight alterations in the usage of mammalian imaging for diagnostics confer benefits when imaging poikilothermic aquatic organisms. It was observed that with the increased detail of CR and DR digital radiology, fish and invertebrates with total lengths of 6–10 cm are now evaluated effectively. Swim bladder disease is one of the more common, confounding diseases with teleosts. In a case study, the koi fish was subjected to CT in case to examine the extent negative buoyancy of the fish due to the possible mass present in the caudal swim bladder. When the fish's anatomy allows it, fluid lines in the swim bladder lumen are best diagnosed radiographically in

standing lateral view. Radiography can be used to guide aspirations as a form of interventional radiology in these cases. Spinal disease is common among teleosts and elasmobranchs. Ante and post mortem radiography can be instrumental in evaluating spinal disease related to age, trauma, nutrition and disease. CT's increased availability and rapid imaging has increased its use among poikilotherms. 3-D reconstructions of CT scans show the complexity of unusual swim bladders in Atlantic spadefish (*Chaetodipterus faber*) and red drum (*Sciaenops ocellatus*). The slow speed of magnetic resonance imaging (MRI) has limited its diagnostic potential, but research studies have found it invaluable. As the technology improves, MRI will become far more useful. A study on *Chaetodipterus faber* using digital radiography, CT and MRI will demonstrate. Endoscopy has a number of uses in fish and invertebrates, including non-invasive examination of gills and minimally invasive visualization/biopsy in the coelom. Gill biopsies evaluate a small fraction of the entire gill surface while endoscopy can be far more comprehensive in assessing gill health. In sea turtles, endoscopy is often the best diagnostic when CT is either unavailable or unrewarding. Endoscopes can also act as direct therapeutic devices which will be demonstrated in treating impactions in marine turtles. Lastly, ultrasonography is actually enhanced in aquatic patients when they are evaluated in the water. Either through training, restraint or sedation, the aquatic environment actually benefits ultrasound image quality.

CONCLUSION

Generally, medical imaging offers non-invasive way of visualization which is amazing what modern medicine can see inside of our bodies. Thanks to the dramatic evolution of the medical imaging and the global medical imaging equipment market is expected to reach 4 billion dollars in 2025. The technologies that are pushing medical imaging designs forward are artificial intelligence which keeps the optimization of the device placement, and help generate faster reports and the next comes the immersive technology which allows the virtual and augmented reality to study the scans in 3D and makes the complex surgeries easier way to understand. CT, PET, MRI, Ultrasound are generally considered as wonders of Medical Imaging as they are incredible forms of technology used to better health in all people. When it comes to aquatic animal imaging, he non-invasive in vivo examination of aquatic organisms has broad application in the study of economic, environmental, and ecological concerns. Clinical applications in economically important species include the evaluation of disease processes for diagnosis and treatment. Valuable information concerning the physiological and biochemical responses of aquatic organisms to disease or environmental factors can be obtained. This non- invasive nature of the procedures makes their use in the study of endangered or physically delicate species potentially valuable.

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