

CARDIOLOGY

NEWSLETTER



CARDIO TECHNOVATIONS

A novel bandage patch for patients requiring cardiac tissue repair

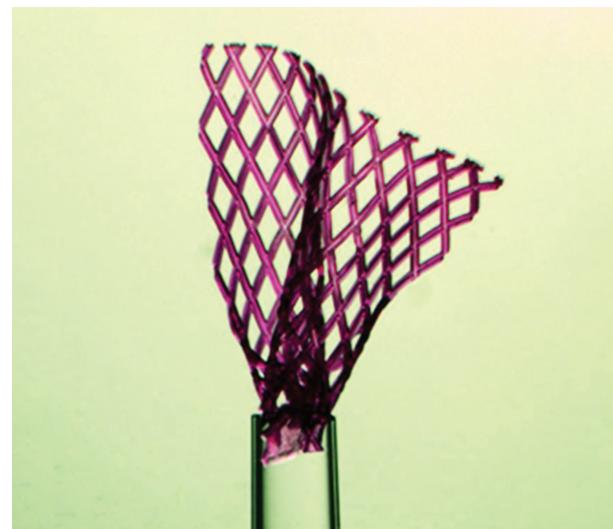
A bandage like patch has been developed by scientists that can be delivered into heart through a needle, in combination with stem cells allowing for minimally invasive cardiac tissue repair, presently an impossible task.

After a massive heart attack, cardiac output can be drastically reduced due to myocardial tissue damage. The capable treatment option is to deliver regenerative cells to the damaged tissue to re-establish its function. Many researchers have investigated using patches to hold the cells in place on the heart surface. Conversely, embedding patches on the heart surface can be risky, as open-heart surgery is unsafe for many patients after a heart attack. An alternative for doctors is to deliver materials or cells using injections from specialized catheters, indicating that the material must pass through a narrow needle without getting damaged. It is quite challenging for a postage stamp-sized patch covered in cells.

The team of researchers in Toronto has developed a biodegradable polymer patch that cardiac cells will gladly grow on. The patch has a shape-memory and will spring back to its original shape once it passes through a needle, leaving the cells undamaged. According to researcher, the lab-grown cardiac tissue was functional and not affected by the injection process, and that was very exciting. Also, he said that heart cells are extremely sensitive, so if they can do it with them, they can also do it with other tissues as well.

The researchers showed that the patch can improve heart function after a heart attack in study model hearts. The hearts pumped more blood after they injected the patch, demonstrating restoration of the heart.

Source: Injectable Tissue Patch to Fix Broken Hearts. Available at <https://www.medgadget.com/2017/08/injectable-tissue-patch-fix-broken-hearts.html>. Accessed on 04/09/2017.



A new approach to measure blood pressure with better accuracy



The present and frequently used automatic blood pressure meters suffer from inaccuracies. An old fashioned auscultatory blood pressure test can avoid inaccurate results, but it has to be carried out by a medical professional.

Researchers have developed a new method that may be more accurate than common oscillometric automatic blood pressure cuffs at measuring the systolic blood pressure. The method uses photoplethysmography, which is an accurate way of detecting the alteration in blood volume within tissue and it works in conjunction with a conventional upper arm cuff. The patient simply slips on what look like pulse oximeters onto both of the index fingers, and the inflatable cuff is wrapped up around the upper arm. The cuff is inflated to a high pressure and then deflated. But, despite of using cuff pressure oscillations to approximate the systolic blood pressure, the new system instead watches how blood saturates the tissue within the fingers as the pressure in the cuff changes. The system compares the saturation between the left and right side as one of the arms has the cuff and the other doesn't. As the pressure goes beyond the systolic blood pressure, the detected pulse disappears and returns when the cuff pressure drops lower than the systolic blood pressure.

Source: New Automatic Technique to Measure Blood Pressure with Greater Accuracy. Available at <https://www.medgadget.com/2017/08/new-automatic-technique-measure-blood-pressure-greater-accuracy.html>. Accessed on 04/09/2017.

Detection of suspicious cardiac murmurs made easy

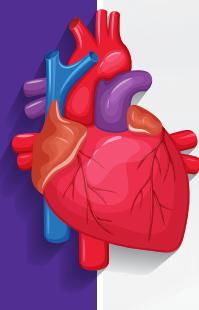
A new device has been introduced that is a novel combination of a stethoscope and ECG in one device. It is proposed to be used by primary care physicians to help spot suspicious cardiac murmurs that should be referred to cardiologists.

The physician places the device frequently on four spots on the chest and each time activates it to record. After this, the device transfers its data to an online processing system that crunches the data and provides outcomes within minutes. The physician can then use this information to decide whether to clear the patient or to refer them to a specialist.

Additionally, this device is promised to make available a new algorithm that is pretty good at detecting arterial stenosis (a common condition resulting in poor cardiovascular health).

Source: Automatic Heart Analyzing CADence System Cleared by FDA. Available at <https://www.medgadget.com/2017/08/automatic-heart-analyzing-cadence-system-cleared-fda-help-primary-care-physicians.html>. Accessed on 04/09/2017.





CARDIO UPDATE

Analyzing the role of low-frequency/high-frequency ratio of heart rate variability analysis in identification of patients with sepsis

The aim of the study is to observe the ability of the low-frequency/high-frequency (LF/HF) ratio of heart rate variability (HRV) analysis and to identify patients with sepsis at risk of early deterioration.

This study is a prospective observational cohort study of patients with sepsis. On presentation, a single ECG Holter recording was obtained and analyzed to obtain the LF/HF ratio of HRV. Primary Sequential Organ Failure Assessment (SOFA) scores were computed. To identify the early deterioration, patients were followed for 72 hours.

Around 466 patients presenting to the ED with sepsis were investigated. Thirty-two (7%) reached at least one endpoint within 72 hours. An LF/HF ratio <1 had a sensitivity and specificity of 34% and 82%, respectively, with positive and negative likelihood ratios of 1.9 and 0.8. An initial SOFA score ≥3 had a sensitivity and specificity of 38% and 92%, with positive and negative likelihood ratios of 4.9 and 0.7. The composite measure of HRV+SOFA had improved sensitivity 56% but at the expense of specificity 77%, with positive and negative likelihood ratios of 2.4 and 0.6. Receiver operating characteristic analysis did not identify a superior alternate threshold for the LF/HF ratio. Kaplan-Meier survival functions differed

significantly ($p=0.02$) between low (<1) and high (≥ 1) LF/HF groups.

The conclusion of the study is that the scientists found a statistically significant relationship between HRV, SOFA and HRV+SOFA, and early deterioration but none reliably functioned as a clinical predictive tool. A more complex multivariable model will likely be required to construct models with clinical utility.

“There is a statistically significant relationship between heart rate variability, sequential organ failure assessment and, heart rate variability with sequential organ failure assessment and early deterioration”

Source: Barnaby DP, Fernando SM, Ferrick KJ, Herry CL, Seely AJE, Bijur PE, Gallagher EJ. Use of the low-frequency/high-frequency ratio of heart rate variability to predict short-term deterioration in emergency department patients with sepsis. *Emerg Med J*. 2017 Aug 18.

Ventricular tachycardia may carry high mortality in pediatric population

The aim of the study was to demarcate the outcome of ventricular tachycardia (VT) in the pediatric population. Patients who developed sustained VT between the ages of 0 and 18 years in a referral centre were enrolled.

A total of 116 patients, 67 male and 49 female had documented VT, and 53 (46%) had associated heart disease, namely cardiomyopathy in 20 (17%), structural heart disease in 19 (16%) and channelopathy in 14 (12%), and some of them presented with 2 types of associated heart disease. Sixty three patients with Idiopathic VT, which presents without associated heart disease, was the most common type. Forty-one patients received catheter ablation, with 37 being successful (90%) and 6 of 37 recurrences (16%). During 5.8 ± 5.9 year follow-up, none of the patients died. VT with cardiomyopathy was associated with the highest mortality rate, mainly in those with hypertrophic and restrictive cardiomyopathy. Among 16 patients initially presenting VT and heart failure, 7 displayed improved heart function after VT control, which could be forecasted by benign onset symptoms, monomorphic QRS morphology and the presentation of VT at the initial diagnosis of cardiomyopathy. Also, VT

associated with structural heart disease was related with a high risk of mortality, but this risk declined after aggressive involvement in the recent years. VT with channelopathy can be often controlled with medication, except for those with prenatal onset.

The conclusion of the above study is that even though VT may carry high mortality when associated with structural anomaly or cardiomyopathy, VT presenting to tertiary referral centre often has a favorable outcome after prompt intervention.

“Ventricular tachycardia may carry high mortality when associated with structural anomaly or cardiomyopathy”

Source: Chiu SN, Wu WL, Lu CW, Tseng WC, Wu KL, Wang JK, Wu MH. Primary ventricular tachycardia in paediatric population in a tertiary centre. *Arch Dis Child*. 2017 Aug 18.

Non-withdrawal of beta blockers in acute decompensated chronic and de novo heart failure with reduced ejection fraction

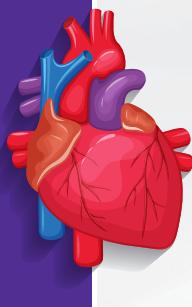
The objective of the study was to reduce the mortality in heart failure (HF) with beta blockers. However, it is not clear whether they should be temporarily withdrawn during acute HF.

A prospective multicentre study of patients hospitalized with acute HF including 5005 patients with acute HF was conducted. The scientists studied the effect of beta blockers non-withdrawal on intra-hospital, 3-month and 12-month mortality and re-hospitalization for HF in patients with acute decompensate chronic heart failure (ADCHF) and acute de novo heart failure (ADNHF) and a left ventricular ejection fraction (LVEF) <40%. The outcome of the study was that 44.1% of patients were already on beta blockers on inclusion. Among those, 57.8% had an LVEF <40%. Furthermore, 79.9% and 20.4% were diagnosed with ADCHF and ADNHF, respectively. Mean age was 61 in the ADCHF group and 59.8 in the ADNHF group. Intra-hospital mortality was less in patients whose beta blocker therapy was not withdrawn in both the ADCHF and ADNHF groups. This protective effect persisted after multivariate analysis and propensity score matching even after correcting for variables that remained significant in the new model. At 3 months, mortality in patients with ADCHF was still lower in whom beta blockers were maintained during initial hospitalization. However, the benefit vanished after correcting for co-founding factors. Interestingly, re-hospitalization for HF and length of hospital stay were unaffected by beta blockers discontinuation in all patients.

The conclusion of the study is that non-withdrawal of beta blockers in acute decompensate chronic and de novo heart failure with reduced ejection fraction is associated with lower intra-hospital mortality but does not influence 3-month and 12-month mortality, re-hospitalization for heart failure, and the length of hospital stay.

“Non-withdrawal of beta blockers in acute decompensate chronic and de novo heart failure with reduced ejection fraction is associated with lower intra-hospital mortality”

Source: Abi Khalil C, Sulaiman K, Mahfoud Z, Singh R, Asaad N, AlHabib KF, Alsheikh-Ali A, Al-Jarallah M, Bulbanat B, AlMahmeed W, Ridha M, Bazargani N, Amin H, Al-Motarreb A, Faleh HA, Elasfar A, Panduranga P, Suwaidi JA; GULF-CARE group. Non-withdrawal of beta blockers in acute decompensated chronic and de novo heart failure with reduced ejection fraction in a prospective multicentre study of patients with acute heart failure in the Middle East. *BMJ Open*. 2017 Jul 9;7(7):e014915.



CARDIOLOGY



CARDIO INTERVENTION

A novel device for patients with severe aortic stenosis

A novel device is introduced in patients with severe aortic stenosis who are considered at intermediate, high, or extreme risk of not doing well from an open heart surgery.

This device features an external porcine pericardial tissue wrap that helps to make close and solid contact between the prosthetic valve and the natural valve opening. This helps to prevent leakages through and on the side of the implant that can seriously weaken the benefits of having a replacement valve installed. The valve is delivered using a delivery catheter system through vessels as narrow as 5.5 mm.



FDA approved certain sizes of the device such as 23 mm, 26 mm, and 29 mm earlier this year. A clinical study was conducted with 60 individuals who met its primary endpoint at 30 days with high rates of survival (98.3%) and low rates of disabling stroke (1.7%). Also, valve showed strong hemodynamic performance with large aortic valve areas ($2.0 \pm 0.5 \text{ cm}^2$) and mean gradients in the single digits ($6.4 \pm 2.1 \text{ mmHg}$) at 30 days. The majority of study subjects (72.4%) experienced no or trace PVL and no incidents of moderate or severe PVL were observed at 30 days. Furthermore, improving on the already low rates seen in clinical studies.

Source: Medtronic CoreValve Evolut PRO TAVR Valve Cleared in Europe. Available on <https://www.medgadget.com/2017/07/medtronic-corevalve-evolut-pro-tavr-valve-cleared-europe.html>. Accessed on 05/09/2017.

A new software for detection of cardiac arrhythmias

A software has been introduced that inspects electrocardiograms (ECG) for any signs of cardiac arrhythmias. The software is based on a neural network which is an artificial intelligence technique that was trained by entering more than half a million previously gathered ECG recordings.

This system lives in the cloud and does not require any apparatus to invest in. The data input is through an online upload, long-term ECG recordings obtained from Holter monitors, ECG patches, and even smartwatches.

Later, the data is carefully analyzed to identify suspect events that look like arrhythmias and points those out to the physician for a detailed review.

When defining the reliability of diagnosing atrial fibrillation (AFib) and other arrhythmias, the term Positive Predictive Value (PPV) refers to the percentage of true positive cases among total cases detected. Conventional PPV detected AFib which is less than 59%. The PPV for Cardiologs' detection of AFib was 91% which was included in the cleared FDA submission. Additionally, it was also included in the cleared FDA submission,



that detecting AFib was described to be 97% (the percentage of positive cases truly identified) and was superior to "state-of-the-art" conventional methods of detecting AFib and other arrhythmias. The study results have been published in the European Journal of Preventive Cardiology (2016, Vol. 23(2S 41-55). The researchers of the study concluded that software technique may be more reliable and accurate than previous methods in the diagnosis of AFib on long-duration ambulatory ECG and other monitoring devices.

Source: Cardiologs Cloud-Based Software FDA Cleared to Spot Arrhythmias in ECGs. Available on <https://www.medgadget.com/2017/07/cardiologs-cloud-based-software-fda-cleared-spot-arrhythmias-ecgs.html>. Accessed on 05/09/2017.



FUTURE TRENDS

Use of endothelial cells to grow capillaries inside 3D printed molds

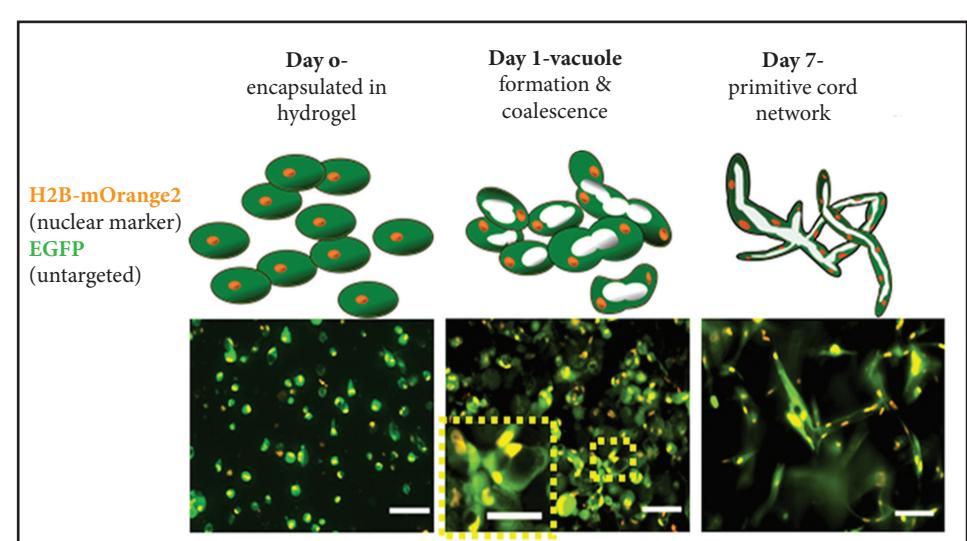
Scientists have conquered an important challenge to use endothelial cells sourced from induced pluripotent stem cells to generate bioengineered blood vessels at Rice University and Baylor College of Medicine. In particular, they were able to observe and guide the formation of tiny blood vessels within specially built molds that promote cellular ingrowths. This development will eventually lead to lab-grown organ replacements immersed with a complex network of vessels, just as within our natural organs.

Researchers used both, fibrin and gelatin methacrylate (a synthetic material) to make the molds. Gelatin methacrylate is 3D printable material which may be suitable for creating customized molds for generation of patient specific replacement vessels.

Rice University shared details of the investigation. They explained that the first step in the experiments was to develop a third-generation lentivirus reporter to genetically modify the cells to produce two types of fluorescent protein, one located only in the nucleus and another throughout the cell. This permanent genetic modification allowed the investigators to non-invasively examine the cell morphology and also identify

the mechanism of individual cell for later quantitative measurements. Next step was to mix these cells with fibrin and incubate for a week. Numerous times in a day, they used microscopes to photograph the growing samples. Thanks to the two fluorescent markers, time-lapse images revealed how the cells were progressing on their tubulogenic odyssey.

Advanced confocal microscopy was conducted at a core facility centre. An open-character of the tubulogenic networks in each sample was used. In fibrin, robust tubule formation was observed. Also, endothelial cells had a more difficult time forming viable tubules in GelMA, a mix of denatured collagen that was



chemically modified with methacrylates to allow fast photopolymerization.

After efforts of several months and dozens of experiments the team developed a workflow to produce robust tubulogenesis in GelMA. This involved adding mesenchymal stem cells, another type of adult human stem cell that had previously been shown to stabilize the formation of tubules.

Source: Researchers Work to Grow Capillaries Inside 3D Printed Molds. Available at <https://www.medgadget.com/2017/07/researchers-work-grow-capillaries-inside-3d-printed-molds.html>. Accessed on 05/09/2017.



Met XL

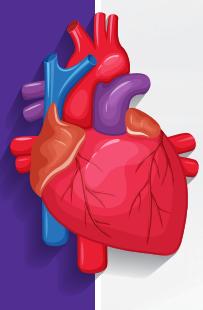
Metoprolol Succinate 50mg / 100mg ER Tablets

APLENE

Pregabalin 75 mg & 150 mg Capsules

ZOLANAS - 30

Lansoprazole 30mg capsules



CARDIOLOGY

A novel device to reduce noisy electrogram signals

A device is introduced with the main aim to reduce noisy electrogram signals during cardiac arrhythmia ablation procedures. With clean signals, cardiologists can locate the areas that generate arrhythmias and ablate them in a better way. For example, with a higher signal/noise ratio, cardiologists may have higher chances to probe the low-voltage areas of the heart. It is important as cardiac arrhythmias affecting 2% of the world, remains as an untreatable challenge in about 50% of ablation procedures.

Patients with cardiac arrhythmias have problems with conductance of the heart. In some cases, the wiring of the heart can short-circuit leading to circular conduction loops that fire and contract the parts of the heart earlier than expected, making the entire heart out of rhythm. Furthermore, in other cases, aberrant tissue can produce random, uncoordinated beats, which also

leads to arrhythmic heart. In both ways, the condition can cause turbulent blood flow that then causes blood clots that get lodged in the brain, potentially causing stroke.

Cardiac ablation is a treatment that works either by destroying the short circuitry or the aberrant generation center to re-establish normal heart conduction or beating. For making this procedure effective, the doctors have to find the cause of the problem. Frequently, they search for late potentials in scar-based arrhythmias, which are not visible through the noise of many existing systems. Furthermore, mapping of atrial fibrillation is complicated due to the small signals generated from the atria.

The cube is a 20 x 20 x 20 cm signal processing box, whose main objective is to simplify locating diseased tissue and works with all diagnostic, mapping, and



ablation catheters on the market today. It acts as a central attachment that plugs into a procedure room's existing medical equipment for rapid setup and use. It converts the signals from the catheters to monitors in the room and can direct RF signals for ablation when the diseased tissue has been located. Significantly, it lowers the noise of the detection signal and facilitates interpretation of where diseased tissue is.

Source: CathVision: A Smoother Look at Cardiac Electrograms. Available at: <https://www.medgadget.com/2017/07/cathvision-smoother-look-cardiac-electrograms.html>. Accessed on 05/09/2017.

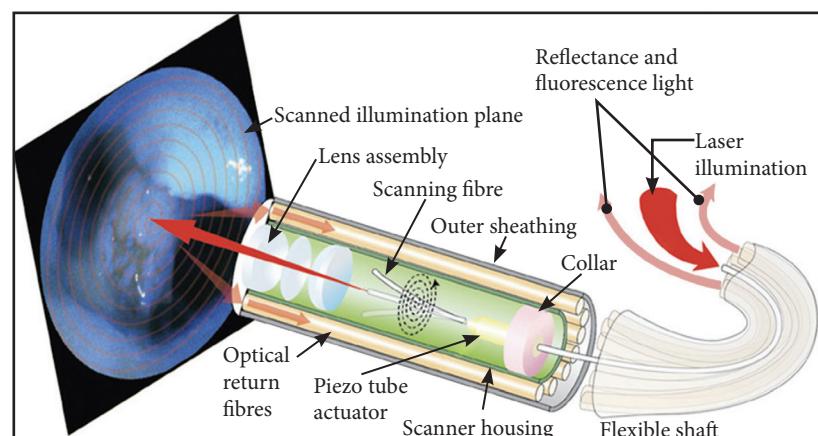
Scanning fiber endoscope to visualize dangerous plaques

A new way of imaging atherosclerosis within blood vessels has been introduced. The technology is based upon transporting a tiny camera into a lumen of a vessel and revealing the plaques using red, green, and blue lasers. The scanning fiber endoscope (SFE) was initially developed to visualize cancer cells, but due to its tiny size and multi-modal imaging warranted testing its potentiality inside of vessels.

This device provides a structural investigation of lesions which leads to strokes

and heart attacks, as well as analyze whether a vessel needs stenting. Additionally, this device may be used as a technology to guide targeted drug delivery and aid physicians in performing vascular procedures.

This imaging system is able to deliver high resolution 3D images of plaques in real-time at 30 Hz, without relying on contrast agents or biochemical labels. The proof of concept trials on study models have shown its ability to provide high quality images of mid-sized vessels, and to help grade plaques as to their danger levels.



Source: Intravascular Camera Using Multiple Lasers for Illumination Helps Assess Dangerous Plaques. Available at: <https://www.medgadget.com/2017/02/intravascular-camera-using-multiple-lasers-illumination-helps-assess-dangerous-plaques.html>. Accessed on 05/09/2017.

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