Robocath

INTUITIVE VASCULAR ROBOTICS

MEDIA KIT

INNOVATIONS IN ROBOTICS SUPPORTING THE MEDICAL PROFESSION

Philippe BENCTEUX
President & Founder

In recent years people have often asked me how I got the idea of launching a medical robotics company.

Robocath was born when I heard about Operation Lindberg, one of the very first remote robot-assisted surgeries, performed by surgeons in the United States on a patient in France, I realized how important this new technology would be in the vascular system.

At the time I was working as a neuro-radiologist. I quickly came to the conclusion that being able to act quickly in the event of a vascular accident could change everything. These accidents cause the vascular system to malfunction, killing millions of people around the world each year. A blood clot forms either in the coronary arteries that send blood to the heart or in the vessels that supply blood to the brain, causing a heart attack or stroke respectively.

Surgical procedures are performed very regularly in this area. In this context, our task was to develop a technological solution capable of replicating and enhance these operations using robotic precision, and contributing to developing better endovascular procedures and safer for patients and staff. The X-rays used in this type of procedure take a toll on the medical staff performing them. The risks have been clearly demonstrated (cancer, musculoskeletal disorders, cataracts, etc.).

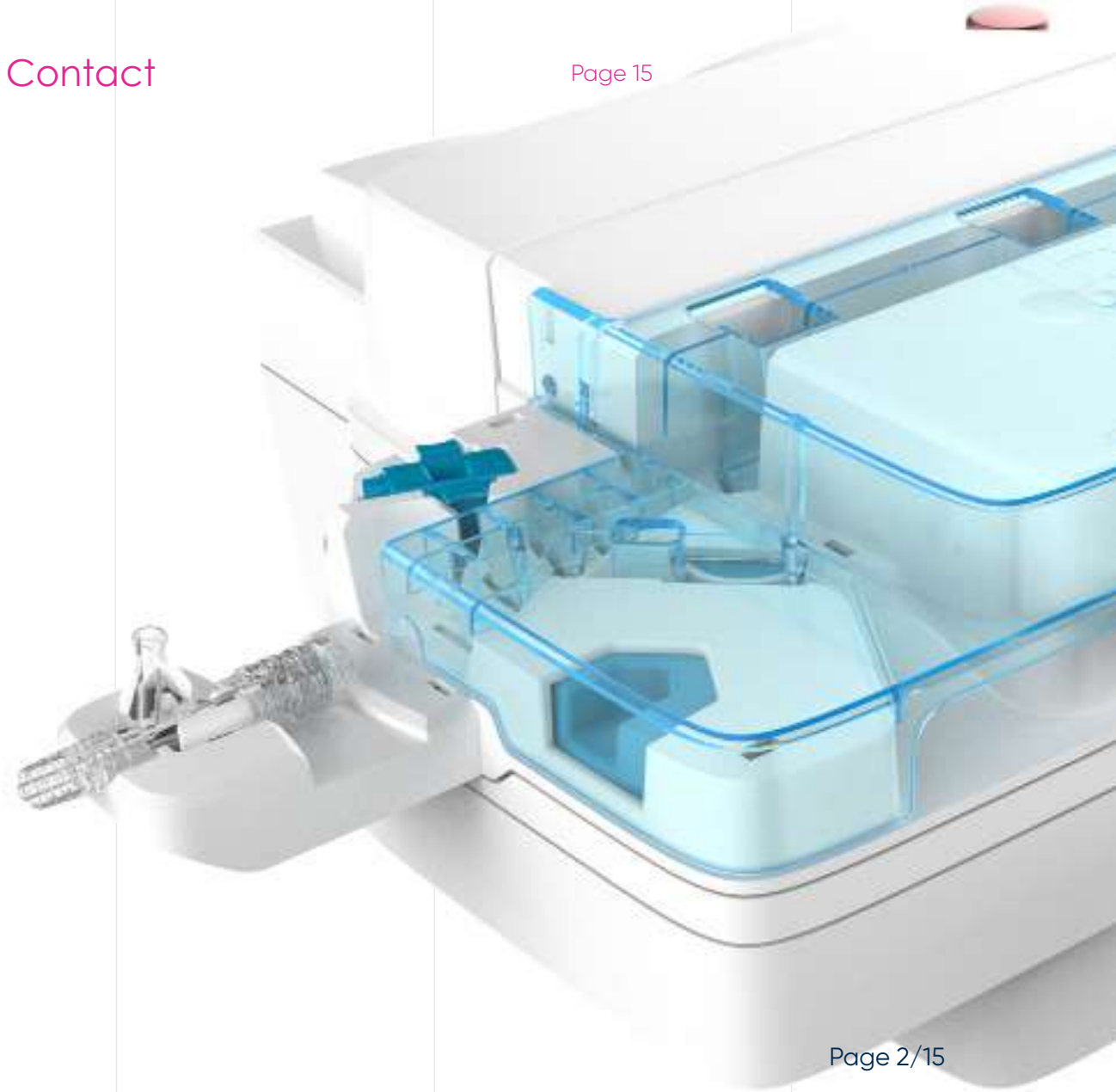
Working as an MD has left me with the firm conviction that robotic assistance shouldn't be seen as revolutionary or an obstacle for the medical profession to overcome. Our solutions must be accessible and intuitive so that medical staff can adopt them quickly and benefit from favorable feedback from the very first trials.

This has been the case with our first robot R-one™, the result of five years of research and development, thanks to the commitment and determination of an entire team of engineers. The results of our Safety & Efficacy study have demonstrated the full potential of our solution. R-one™ is used in interventional cardiology to treat coronary diseases that can lead to a heart attack. We just started to market it in Europe.

This will lead to the realization of a three-fold ambition: to create new technologies to improve patient care, to improve the safety for medical staff and to improve their operational effectiveness in order to benefit the entire healthcare system.

Innovation is part of our DNA. We are also developing new robotics platforms that will be used in the near future for the entire peripheral vascular system. Further down the line, they will also be available for use in the neurovascular system, in particular to remotely treat strokes on emergency wards. We will continue to focus our attention in this area, working closely with leading physicians.

Summary



ABOUT ROBOCATH

Founded in 2009 by Philippe Bencteux, MD, Robocath designs, develops and commercializes robotic solutions to treat cardiovascular diseases. As an active player of medical robotic mutation, thanks to reliable technologies, these developments aim to make medical procedures safer and complementary with manual interventions.

R-One™ is the first technology developed by Robocath. It is a unique technology that optimizes the safety of robotic-assisted coronary angioplasty. This medical procedure consists of revascularizing the cardiac muscle by inserting one or more implants (stents) into the arteries that supply it with blood. This type of procedure is performed every 30 seconds somewhere in the world.

R-One™ is designed to operate with precision and specific movements with better interventional conditions. Thanks to its open architecture, R-One™ is compatible with market leading devices and cath labs. It received the CE marking in February 2019.

Robocath aims to become the world leader in vascular robotics developing the remote treatment of vascular emergencies, guaranteeing the best care pathway for all.

Based in Rouen, Robocath has more than 25 employees. It is financially supported by regional investment funds (NCI, Normandy participations, GO CAPITAL) and national investment funds (M Capital, Supernova Invest) as well as by many business angels, banks (Caisse d'épargne, BNP Paribas,CrédCrédit Agricole) and Bpifrance.

MANAGEMENT

Lucien GOFFART
CEO

Holding a master's degree in Business, Lucien Goffart started his career in 1999 at Johnson & Johnson Inc. Then, he joined Abbott before holding different positions at Volcano company between 2004 and 2011. From 2012 to 2014, he held different executive positions at Stentys and Mitralgin. Last four years, he served Boston Scientific as Business Unit Manager France. In the meanwhile, he was Board member of several companies from the Medtech industry such as Opsens Medical. Since 2019, he is Board member of Electroducer and was appointed CEO of Robocath in September.

Philippe BENCTEUX
President & founder

A doctor of medicine and a graduate of the 'Healthcare Industry Strategy and Management' program at ESSEC Business School, Philippe Bencteux has over twenty years of experience in vascular imaging. A trained neuro-radiologist, he founded Robocath in 2009 on the basis of the promising preliminary research carried out in collaboration with two engineering schools. He has since contributed his expertise in the medical sector to the company and is actively involved in the conception of new robotics solutions.

Dominique DESTRIEZ
CFO

Graduated from HEC and holding a Phd in accountancy, Dominique DESTRIEZ started his career in international audit and management accounting within large companies afterwards. He then joined Nocibé, a french comestic group, as financial director and played an active role in the company's growth from 1999 to 2004. For over 15 years, Dominique supports investment funds and their participations to achieve financial structuring, M&A, funds raising, international development.

Bruno Fournier
CTO

Bruno Fournier is a trained engineer (Supélec) and Doctor of Science (Université Paris VI), with strong R&D experience in the healthcare sector. He led the development of products with high added value in several fields (ultrasound, bone density measurement, respiratory support, etc.). Passionate about new medical technologies, he joined Robocath in 2012 after management roles with the Air Liquide Groupe and his time as Director of R&D at one of Getinge Group subsidiary from 2006 to 2012.

Workforce as of 30th of August, 2019

26 people

OUTSTANDING FEATURES

2009

Creation of the company

Support from local stakeholders (state subsidies) including BpiFrance and the Haute-Normandie region

2013

First In Vivo tests successfully performed

1st fundraising bringing a total of €900k ($1.1M) from local investment funds

2014

ISO 13485

Standard for medical devices

2015

Industrial Prototype

2nd fundraising bringing a total of €900k ($1.1M) from historical funds (GoCapital and NCI)

2016

Pre-series launch

Industrial partners certification

2017 2018

Safety-Efficacy Study

Fundraising bringing a total of €6.4 million ($7.7M) from historical investor and new ones (M Capital, AD Normandie and Supernova Invest) in May 2017 and December 2017

2019

Pre-launch in Europe

CE Approval (feb 19)
Fundraising bringing a total of €5.0 million (sep 19)

MEDICAL ADVISORY BOARD

This medical advisory board, including global experts and recognized leaders in interventional cardiology, will help define the clinical strategy of the company and more broadly contribute to the development of future generations of Robocath's robotic system products.

Dr. J FAJADET

Co-director of the cardiovascular disease department at the Clinique Pasteur in Toulouse (France), co-director of EuroPCR, one of the most important interventional cardiology congresses in the world. Director of the EAPCI, (European Association of Percutaneous Cardiovascular Interventions) between 2011 and 2014. He is the author of numerous publications and holds several major awards.

Pr. A CRIBIER

Professor of medicine and former chief of the cardiology department at Rouen University Hospital, conceived and developed the TAVI (Transcatheter Aortic Valve Implantation) procedure, a breakthrough, less invasive interventional treatment for structural heart diseases. Since its creation, the device has been implanted in thousands of patients around the world. He is the author of more than 600 publications and has received several major international medical and scientific awards.

Pr. G STONE

Professor of medicine and director of cardiovascular research and training at the Center for Interventional Therapy at Colombia University Medical Center and at the Cardiovascular Research Foundation, both in New York. Regularly engaged in clinical research and professional education, he has led and published more than 2,000 manuscripts and abstracts and has received several major awards for his work. He is director of the TCT Congress (Transcatheter Cardiovascular Therapeutics), one of the largest interventional cardiology gatherings in the world.

Pr. A CREMONESI

Head of the Villa Maria hospital cardiovascular department in Bologna (Italy) for the last 25 years, published many interventional cardiology and peripheral vascular papers. From 2011 to 2013, he was president of the Italian society of interventional cardiology. He has for many years been an active member of the PCR board and received several awards in recognition of his achievements.

Pr. E DURAND

Chief of cardiovascular unit at Rouen University Hospital. He has published cardiovascular papers and has actively contributed to the developement of R-One™.

Pr. R SABATIER

Interventional cardiologist at Caen University Hospital. He has published papers in the cardiovascular and telemedicine field. He has also actively contributed to the development of R-One™.

Pr. M HAUDE

Head of the cardiac catheterization laboratory in Neuss Clinic for the 25 last years, past chairman of the Working Group on Interventional Cardiology (AGIK) at the German Society of Cardiology, PCR and ESC board member and EAPCI president from 2016 to 2018. Currently an EAPCI board member, Pr. Haude has published more than 300 scientific articles.

Dr. F LORGAT

Interventional cardiologist at Christiaan Barnard Memorial Hospital since 1998. One of the first users of a robotic system for electrophysiology, Dr. Lorgat has performed more than 1,600 procedures with this robotic assistance over a period of 6 years and is an active research contributor in this field.

Pr. H NEF

Head of the cardiac catheterization laboratory in Giessen University Hospital for the last 10 years. Director of the department for structural heart disease in the Herz-Kreislauf-Zentrum, Rotenburg, Germany. President of the Working Group on Interventional Cardiology (AGIK) at the German Society of Cardiology since 2015, Pr. Nef is the author of numerous scientific publications and plays an active role in professional education.

AWARDS

4th French medical start-up[1]
Forbes magazine
2017

Trophée de l'avenir Nominee
Health field
Europe 1
2018

French start-up of the year Nominee
EY
2018

PARTNERS

1/ Ranking criterions were total fund raising, visibility, workforce and the potential of the innovation created.

PATHOLOGICAL CONTEXT

Cardiovascular disease is the leading cause of death worldwide

According to the WHO, cardiovascular disease is responsible for 17.5 million deaths annually, making it one of the leading causes of death worldwide[1]. The main causes are coronary heart disease (7.4 million deaths in 2012) and strokes (6.7 million deaths in 2012).

This has been the case for 15 years, despite improvements in treatment and prevention. Deaths linked to this type of pathology have even started to increase in recent years as a result of several factors, such as the ageing population and global population increase.

Cardiovascular disease is mainly caused by the formation of clots or fatty deposits on the internal walls of the blood vessels, obstructing the blood supply to the heart or brain.

1/ in 2012 - Source : OMS, factsheet 310, 2016

THE CURRENT STANDARD OF CARE: INTERVENTIONAL CARDIOLOGY

Today, coronary heart disease is mainly treated using interventional cardiology.

This minimally invasive surgical procedure involves placing a stent (metal implant) at the location of the targeted lesion using a catheter and a guidewire (instruments used percutaneously to reach the artery that requires treatment) in order to restore normal arterial circulation. This procedure is called a PCI (Percutaneous Coronary Intervention). Today, as a result of the advantages associated with interventional medicine, this is the most common procedure. It considerably limits surgical trauma in comparison with traditional surgery, reducing pain, intraoperative hemorrhaging, hospitalization time and the parietal after effects (scarring), etc.

INTERVENTIONAL CARDIOLOGY: SIGNIFICANT RISKS

Although interventional cardiology is currently the treatment of choice for coronary disease, it poses significant risks.

For medical staff, PCI currently presents certain risks that have been demonstrated by a number of studies and which limit the use of this technique in certain indications.
In an interventional cardiology procedure, the doctor must be able to see the lesions in the coronary arteries in order to treat them. However, the only option currently available is to use a radiology scanner (C-arm - presented opposite) to obtain a feedback image of the patient's thorax. Injecting a contrast agent into the targeted lesion enables the doctor to see the obstructed artery at any given moment.
The radiological instrument used emits X-rays, which can cause serious diseases and pathologies in the medical staff, such as cancer (see box below).

For the patient, the use of interventional medicine can be limited as certain products such as iodine can present a risk for certain patient profiles. In addition, it requires a high level of precision under many constraints (lead apron, standing position, stress, etc.).

Ionizing rays cause recognized professional pathologies

- x8: The risk of developing cancer increases eightfold [1,2,3,4,5]
- x9: The risk of developing a cataract increases ninefold [6,7]
- Thyroid problems, skin lesions, etc.

To obtain a certain level of protection, medical staff must wear a lead apron

This weighs around 10 kg and causes MusculoSkeletal Disorders (MSD).

- x6: The risk of developing MSD increases six-fold, due to prolonged wearing of a lead apron [8,9]
- 55% of hospital staff performing interventions suffer from MSD [8,9]

1 Picano E., Vano E., Domenici L., Bottai M., Thierry-Chef I., Cancer and non-cancer brain and eye effects of chronic low-dose ionizing radiation exposure, BMC Cancer, 2012, 12:157

2 Ryan R. Reeves, MD, Lawrence Ang, MD, John Bahadorani, MD, Jesse Naghi, MD, Arturo Dominguez, MD, Vachaspathi Palakodeti, MD, Sotirios Tsimikas, MD, Mitul P. Patel, MD, Ehtisham Mahmud, MD, Invasive Cardiologists Are Exposed to Greater Left Sided Cranial Radiation The BRAIN Study (Brain Radiation Exposure and Attenuation During Invasive Cardiology Procedures), JACC: CARDIOVASCULAR INTERVENTIONS VOL. 8, NO. 9, 2015

3 Lucia Venneri, Francesco Rossi, Nicoletta Botto, Maria GraziaAndreassi, Nicoletta Salcone, Ahmed Emad, Mauro Lazzeri, Cesare Gor, Eliseo Vano, Eugenio Picano, Cancer risk from professional exposure in staff working in cardiac catheterization laboratory: Insights from the National Research Council's Biological Effects of Ionizing Radiation VII Report, American heart journal Volume 157, Issue 1, January 2009, Pages 118-124

4 Roguin A, Goldstein J, Bar O,. Brain and Neck Tumors Among Physicians Performing Interventional Procedure. Am J cardio 2013;11(9):1368-72

5 Richardson et al., Risk of cancer from occupational exposure to ionising radiation : retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS) (2015) British Medical Journal Risk of cancer from occupational exposure to ionising radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS)

6 Vano E, Kleiman NJ, Duran A, Rehani MM, Echeverri D, Cabrera M., Radiation cataract risk in interventional cardiology personnel, Radiat Res. 2010 Oct;174(4):490-5

7 Jacob S, Boveda S, Bar O, et al. Interventional cardiologists and risk of radiation-induced cataract: results of a French multicenter observational study. Int J Cardiol. 2012;15:476-7

8 N. Orme et al. Occupational health hazard of working in the interventional laboratory (2015) Journal of the American College of Cardiology

9 Nathaniel R. Smilowitz, Stephen Balter, Giora Weisz, Occupational hazards of interventional cardiology, Cardiovascular Revascularization Medicine 14 (2013) 223–228

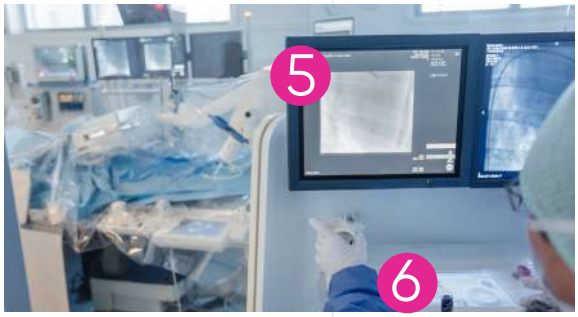
R-ONE™ ROBOTIC PLATFORM: A UNIQUE SOLUTION ACROSS EUROPE PROTECTED BY 60 INTERNATIONAL PATENTS

HOW DOES IT WORK?

R-One™ robotic assistance platform was designed to answer interventional cardiology needs.

R-One™ is composed of two key elements. The integrated control station (1) that includes the command unit (joysticks and high-definition monitors) and a lead shield to protect medical staff from X-rays. The cardiologist can use the control console to move the robot (2) remotely, enabling the guidewire[1] and the catheter[2] to be inserted with precision, making navigating the instruments within the vascular system safer and more precise.

The guidewire and the catheter are both inserted into the robot (3,4) and enter the vascular system by means of remotely controlled movements made by the cardiologist from the integrated control station (5). The joysticks (6) are used to control and secure the movement of these instruments within the vascular system until they reach the lesion.



1/ Guidewire: a tiny instrument inserted into the artery to gain access to the lesion; 2/ Catheter: the instrument that bears the stent that enables blood circulation in the obstructed artery to be restored.

Bruno FOURNIER
R&D director

R-One™ is unique, designed to make the procedure safer without reducing the workflow

The first patent was filed in 2005 with the support of an engineering school (ESIGELEC) and INSA (the French National Institute of Applied Sciences). It was the first robotic assistance platform for interventional cardiology with two main types of technology. These have proven key to our success. The first is an anthropomorphic system that enables the performance of both a rotating action and another movement at the same time. This technology enables the recreation of medical actions to make them more reliable, with a high degree of precision. The second ensures that instruments remain perfectly still throughout the procedure, preventing loss of access to the lesion. While access to the lesion may be lost during a manual procedure, R-One™ makes the operation safer, for the benefit of the whole medical care system.

MAIN BENEFITS

Enhanced movement

In addition to its anthropomorphic nature, replicating hand movements identically, R-One™ offers a greater level of freedom of movement than a manual procedure (repeatability, one-handed guidance, etc.). This presents new movement possibilities like continuous rotation (Easy-Loop®).

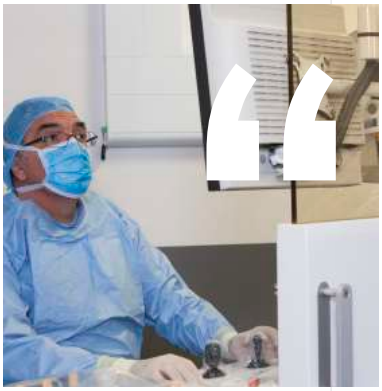
Robotic precision

- R-Grasp®: this unique, anthropomorphic technology facilitates the navigation of instruments inside the vascular system, making it possible to reproduce hand movements at any point (independent or simultaneous rotation and translation). The right joystick alone enables the guidewire to be navigated into position. The left joystick controls the catheter stent/balloon previously placed on the guide. This intuitive control system allows physicians to easily familiarize themselves with it.
- R-Lock®: Locking the guidewire in the robotic unit ensures that it remains perfectly stable throughout the intervention and that access to the lesion is maintained during the procedure. This system significantly improves interventional conditions.

Comfort and safety for medical staff

- Radio-Stop®: thanks to the mobile radioprotection control station, interventional cardiologists can carry out interventions remotely. This means they are protected from x-rays, known to cause recognized occupational diseases such as cancer. The intervention is carried out in a safe environment, with considerably reduced stress levels for physicians.
- Ergonomic position: procedures are carried out while seated at mobile radioprotection control station.
- Close visualization: visual proximity with radiography screens

TESTIMONIES



Dr. J FAJADET
Co-Director of EuroPCR and interventional cardiologist at the Pasteur Clinic, Toulouse (France)

R-One™ is a very intuitive tool. It is quick and easy to set up. Access to the lesion is maintained at all times thanks to the guide locking system. It is a significant revolution in our profession.

Pr. A CRIBIER
Emeritus Professor, TAVI's father
Rouen University Hospital (France)

R-One™ represents a major step forward in interventional cardiology. I am very impressed by the robot, which will bring real benefits to the healthcare system.

Dr. R SABATIER
Interventional cardiologist at Caen University Hospital (France)

Getting started is very easy and intuitive. The fact that the robot's behavior is consistent means the risk of human error can be reduced.

FACTS AND FIGURES ON MEDICAL ROBOTICS

From computer-aided surgery to minimally invasive robotic surgery

1987: First minimally invasive surgical intervention (gallbladder removal). This sector has since developed gradually, following changes in technology and research in this area.

2000s: From this decade on advances in minimally invasive robotic surgery have really gained momentum. The first system of note was AESOP (Automated Endoscopic System for Optimal Position) developed by Computer Motion. Shortly after this system was marketed, Intuitive Systems created the Da Vinci® system used in several areas (hysterectomy, mitral valve repair and prostate surgery). Following this, Mako Surgical marketed the RIO robot in orthopedics.

2011: An estimated 1.5 million procedures were carried out with the assistance of a medical robot.

Today: Robotic assistance in the medical and surgical sector is increasing significantly around the world (see the graph p.13) as a result of the numerous benefits it provides for both patients and medical professionals.

It is used in many areas to a greater or lesser degree depending on the options for applying existing and marketed technology:

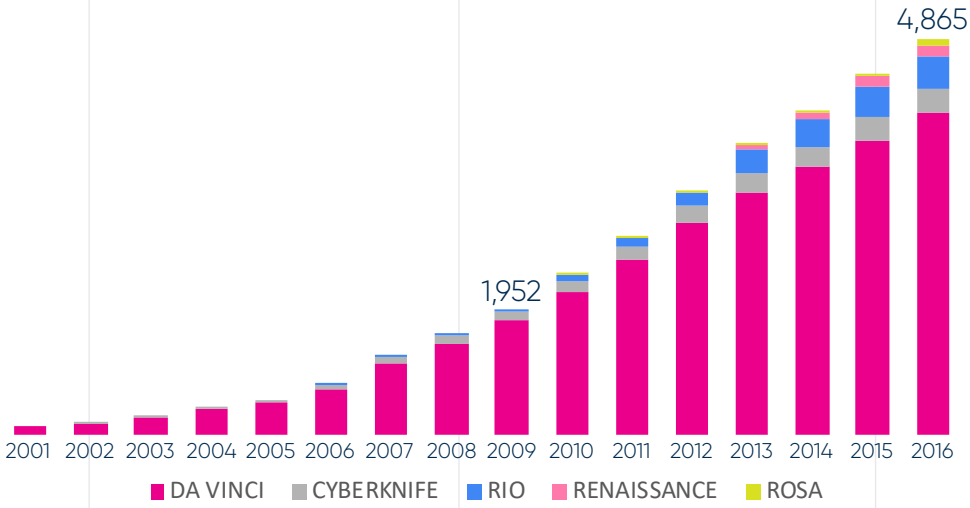
- General surgery
- Urology
- Orthopedics
- Gastro-intestinal surgery
- Neurosurgery
- Cardiothoracic surgery
- Gynecology
- Radiology
- Cardiology

Aesop™

Da Vinci®

Rio®

Robots installed base worldwide

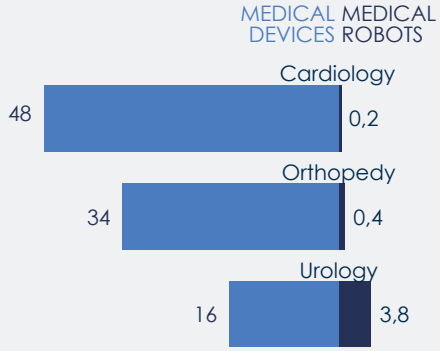


Source: finanical reports of companies listed

Cardiology is currently one of the areas in which medical robotics are least prevalent.
This constitutes a real opportunity for Robocath.

Robotic penetration by sector

In billions of dollars



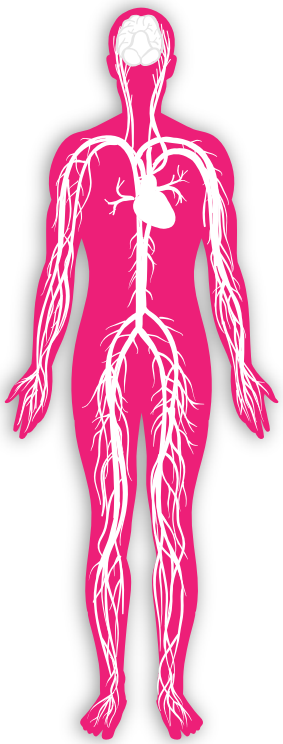
Our targeted market:

16,000
catheterization rooms

4 million
PCI's per year

gobal data

A CLEAR ROADMAP



2019[1]

INTERVENTIONAL CARDIOLOGY

Coronary arteries treatment

2022[1]

PERIPHERAL VASCULAR AND NEUROVASCULAR

Peripheral arteries and brain vessels

>2023[1]

REMOTE CARE

Patient care during vascular emergencies (infarction and stroke)

[1] market launch

Innovation is at the heart of Robocath's growth strategy

New patents are regularly filed for technologies that will be used in future medical specialties. Robocath's aim is to guarantee the same access to treatment for all through the development of remote interventions, including the remote treatment of vascular emergencies such as strokes. This model will provide better care for this type of pathology, more quickly and under better conditions. Research is currently underway to develop robotics platforms for peripheral vascular and neurovascular procedures.

PRESS CONTACT

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