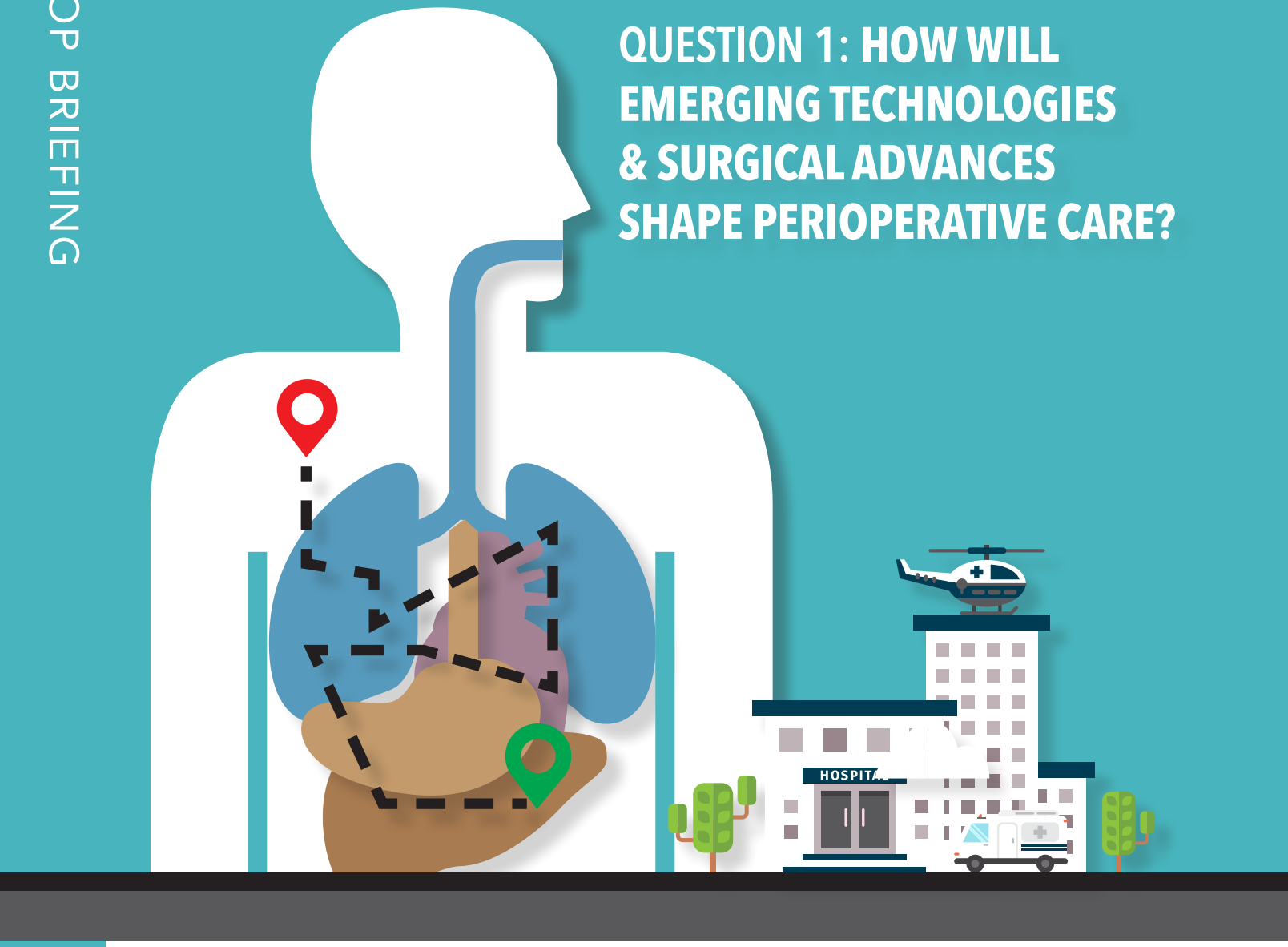
QUESTION 1: HOW WILL EMERGING TECHNOLOGIES & SURGICAL ADVANCES SHAPE PERIOPERATIVE CARE?



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The growth of minimal access, image-guided, computer-aided procedures in every surgical specialty is a trend that will continue. Complex procedures currently performed via an open approach by most surgeons, such as pancreatectomy and liver procedures, will be able to move to minimal access, technology-enabled platforms.

Every year our tools are better in terms of visualization, flexibility, and the way we can handle tissues remotely. The size of incisions will be dictated by the size of the specimen to be removed, which is the limiting factor rather than the size of instruments.

Three-dimensional (3D) imaging will allow us to see and interface with tissue differently.

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Preprocedural image planning allows us to practice "precision surgery." Many are familiar with precision medicine, which is targeted molecular therapy; precision surgery uses imaging and computers to improve fluency of action between the surgeon's fingers and what is actually being done for that patient. Three-dimensional (3D) imaging will allow us to see and interface with tissue differently. We will 3D print a patient's breast that harbors a cancer to guide a lumpectomy during breast-conserving therapy or an aorta to rehearse an endovascular procedure. When coupled to computer-aided technologies, we will be able to preprogram the procedure into our robotic devices that we use in the OR now.

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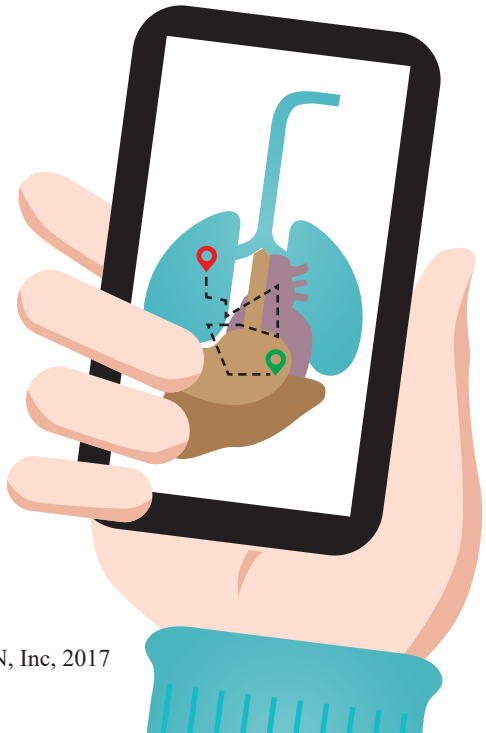
We are in the information age. It is possible that Apple or Google will be able to monitor patients through Fitbits,® smartphones, and internet-linked technology better than I can monitor them in the clinical setting now. The future is telemonitoring large numbers of patients at once whose vital signs are all streaming into a control center where there is a technician to review the raw data, a nurse practitioner to address common issues, and a physician available to deal with serious issues. All this will change how we think about and treat patients. One trend may be to consider whether we will even need hospitals anymore; driven by information technology, the hospital of the future may only be for surgical procedures and not housing patients.



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An intelligent OR could interact with the surgical team to let them know what instruments are needed at what time throughout the procedure. Operating with team members who are unfamiliar with a procedure or who have minimal team preparation can introduce errors. Technology can help to reduce these errors.

In minimally invasive surgery, the trocar is the access point for every maneuver. A smart trocar augmented with a tiny, high-definition camera that communicates instrument labels to a computer system wirelessly can be used to create a statistical model of the surgery and is a simple, robust technology. The statistical model may reveal ways to improve perioperative efficiency. In addition, a smart trocar could alert users to any missed steps, missed orders, or malfunctioning instruments. A smart trocar is an example of a technology that does not interfere with surgeons, nurses, or other team members. A smart trocar could also localize itself in space like a global-positioning system to track the movement of instruments. For example, this system could detect if the surgeon is tired and shaking or maneuvering inefficiently.

Surgeons must mentally reconstruct patients' anatomy based on imaging studies. The future is a real-time navigation system that updates the anatomy throughout a procedure. For example, a surgeon performing a liver resection could start with an image of a tumor's location obtained before surgery but images that are updated throughout the procedure help the surgeon see what is changing, similar to a real-time car navigation system that takes into account the changing landscape. A system like this might be able to predict the likelihood of a better outcome if certain tissue or vasculature is removed. This revolutionary technology can help surgeons make decisions and identify 'no-fly zones' (i.e., anatomical structures or spaces to avoid because of the possibility of damage to nearby tissue).