Personal view: going around in circles — circuitous medical management plans

A. SONNENBERG
Gastroenterology, Portland VA Medical Center and Oregon Health & Science University, Portland, OR, USA
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SUMMARY
Physicians occasionally embark on a work-up that, after a lengthy path, leads them to a clinical situation similar to that from which they started their original pursuit. This article aims to describe the characteristics of circular medical management and means for its avoidance. The underlying medical problem often presents itself initially as a bewildering array of consecutive outcomes similar to a complex decision tree. On closer inspection, however, few of the outcomes are associated with a high probability, and only one path stands out as the most likely one to take. This path usually ends in such options as expectant management, supportive measures or doing nothing, which are already available at the onset of work-up. If medical management is drawn out and takes a long time to complete, sight of its circular nature is easily lost. If many different specialists care for a patient, little appreciation for circular paths occurs. A prospective outline of the management plan and the elimination of paths with low a priori probability can help to prevent unnecessary medical interventions. The physician may then come to realize that standing still and waiting become as effective and less costly than a lengthy circular work-up.

INTRODUCTION
Physicians occasionally embark on a diagnostic and therapeutic work-up that, after a lengthy path, leads them to a clinical situation identical or similar to that from which they started their original pursuit. Investment occurs in costly and time-consuming medical procedures for the acquisition of knowledge with little or no therapeutic consequence. After extensive effort to determine the diagnosis or advance the medical decision process, the patient and physician face the same options as at the onset of disease management. Consider, for example, a patient with liver metastases, in whom an extensive work-up with various endoscopic procedures, imaging studies and interventions is initiated to find the primary tumour and obtain a definitive tissue diagnosis. After completion of multiple tests, the conclusion is reached that little can be done at this advanced stage of the disease and that the patient’s well-being is best served with supportive therapy alone, an option that was clearly available at the beginning of the process. In another example, a patient with Barrett’s oesophagus is recruited into a surveillance programme for the early detection of high-grade dysplasia or cancer. Ten years after the initiation of the surveillance programme, when high-grade dysplasia is actually found, the patient is deemed to be a poor operative candidate and surveillance is continued, albeit at much shorter time intervals. Figure 1 represents a generalized scheme of the underlying phenomenon. Instead of taking the initial exit, often comprising expectant or supportive measures only, medical management advances along a circular path that, after multiple tests and therapeutic
that underlie the occurrence of circular paths and design rules for their avoidance.

**CASE SCENARIO 1: BARRETT’S OESOPHAGUS**

In the ‘Introduction’ section, the example of Barrett’s oesophagus was alluded to in its simplest form, when a patient moves between two states only. Figure 2 outlines a more complex and lengthier path. At the onset of the management plan, there is clearly the option to forgo surveillance altogether and manage the patient expectantly. Surveillance is conducted under the premise that the early detection of high-grade dysplasia will result in some type of intervention, such as photodynamic therapy, endoscopic mucosectomy or surgical oesophagectomy. At the time when high-grade dysplasia is first encountered, however, these various therapeutic options may not be readily available. Being asymptomatic, the patient may opt against any invasive intervention that serves essentially as a prophylactic measure. Lastly, both patient and physician may decide that high-grade dysplasia still represents a relatively benign lesion and only a relative indication for oesophageal resection or ablative therapy. Such therapeutic interventions could be further delayed until early cancer develops and therefore a more frequent surveillance schedule is implemented. Years later, at the time of the eventual cancer, the patient may no longer be considered a candidate for oesophagectomy because of his/her advanced age or because other underlying medical problems have emerged, and the cancer may be dealt with through stent placement and other supportive measures.

![Diagram of circular management path](image-url)
Bold arrows and grey boxes highlight the actual circular path. Broken arrows and white boxes represent hypothetical paths that can lead out of the circle but never truly materialize. The circular path usually takes many years to complete. The patient may spend several years undergoing surveillance for Barrett’s oesophagus alone or Barrett’s oesophagus associated with high-grade dysplasia, and many different physicians may be responsible for the patient’s management during various stages of the disease process. Because the circular path becomes so drawn out and individual physicians manage the patient for only a limited distance during his/her entire passage, ultimately, the realization that the patient has moved in a circle may be lost on the various parties involved in the management process.

CASE SCENARIO 2: ABDOMINAL SWELLING

A cachectic patient with markedly reduced health status was admitted to the Gastroenterology Service for abdominal swelling. The patient complained of constipation, nausea and vomiting. The abdominal examination revealed a large palpable indurated mass of the upper abdomen and possible ascites. It was clear from the onset that the patient most probably harboured some consumptive abdominal cancer (Figure 3). A subsequent computed tomography scan demonstrated free intraperitoneal fluid and a soft tissue mass in the lesser sac, extending along the lesser curvature of the stomach into the porta hepatis region. A paracentesis failed to yield a definitive tumour diagnosis. The patient also underwent an oesophago-gastro-duodenoscopy and a colonoscopy, which both confirmed an outside compression, but revealed no mucosal abnormality. A computed tomography-guided biopsy of the tumour mass yielded tissue from an undifferentiated adenocarcinoma of unknown origin. Because of the advanced stage of the disease, the managing oncologist opted against any radiation or chemotherapy and the patient was discharged home.

In this example, again, bold arrows and grey boxes highlight the actual circular path, and broken arrows and white boxes mark the hypothetical paths (Figure 3). The multiple possible treatments associated with the diagnosis of colon cancer or other cancer types are marked as exits but not drawn out in any detail. In the present more than in the previous scenario, the actual circle tends to be obscured by the large variety of paths that could potentially lead out of the circle. The physicians who embarked on the management of this patient would have described the bewildering variety of possible diagnoses and treatments as a bushy tree with multiple side-branches rather than a circle. In addition to the diagnostic procedures shown in the graph, as the work-up of this patient progressed, it could also have easily included a computed tomography scan of the chest, pleurocentesis, bronchoscopy, liver biopsy, nuclear scans and many other tests with other potential diagnoses and therapies. The circle ensued because, from the onset, all exits from the circle were associated

Figure 3. Circular path in the management of a patient with an intra-abdominal tumour. CT, computed tomography; EGD, oesophago-gastro-duodenoscopy.
with a relatively low probability. Although the driving force behind the work-up was to find a treatable tumour, the actual probability for such a favourable outcome must be judged as rather small.

CASE SCENARIO 3: BRIGHT RED BLOOD PER RECTUM

In an elderly patient with bright red blood per rectum, both an upper and lower gastrointestinal endoscopy performed shortly after the onset of bleeding failed to reveal a bleeding site. Apart from a few minor erosions, the upper gastrointestinal tract appeared normal without any obvious bleeding source. Because the colon wall was covered with dark blood, it was impossible for the endoscopist to ascertain any definitive bleeding site. The colonoscopy was repeated 1 week later after the bleeding had stopped. It demonstrated a clean colon without any apparent bleeding sites. Intubation of the terminal ileum also failed to show any mucosal abnormality. A repeat examination of the upper gastrointestinal tract was again largely normal.

This patient constitutes a relatively common scenario in gastroenterology. In addition to the endoscopic procedures in Figure 4, the set of diagnostic techniques may include a tagged red blood cell scan, radiological examination of the small bowel, video capsule and angiography.5, 6 This scenario represents a typical example of the type of path that patients and their physicians tend to circle more than once. The patient often presents more than once with the same type of bleeding that is considered to be serious enough to justify a repeat work-up. Physicians may also justify sets of repeat examinations by citing small procedural changes, such as different investigators, different instruments and variations in procedural technique. Again, the relevance of potential findings and the variety of potential means to intervene effectively are listed as reasons for conducting the work-up. According to Bayes’ formula, however, the probability of finding a positive diagnosis decreases markedly if previous attempts have already yielded a negative diagnosis.7

Given a pre-test probability \( P \) and a negative test outcome, the post-test probability is calculated according to Bayes’ formula for a negative predictive value (NPV)

\[
\text{NPV} = \frac{(1 - \text{sens}) \times P}{(1 - \text{sens}) \times P + \text{spec} \times (1 - P)}
\]

Let us assume, for example, that upper gastrointestinal endoscopy is characterized by a sensitivity (sens) of 70% and specificity (spec) of 90% for finding the cause of upper gastrointestinal bleeding. After a negative endoscopy, a pre-test probability \( P = 50\% \) for an upper gastrointestinal bleeding source would change to a new post-test probability \( \text{NPV} = P_{1} = 25\% \). After a second or third negative endoscopy, the probability would decline even further to \( P_{2} = 10\% \) or \( P_{3} = 3.6\% \), respectively.

DISCUSSION

The three examples given above reveal the following characteristic features of circular paths. The medical problem presents itself initially as a bewildering array of possible diagnoses and therapies that could be readily depicted as a complex decision tree. On closer inspection, however, all but a few of these many outcomes are associated with a low a priori probability, and only one path stands out as the most likely one to take. There is also nothing mysterious about the circular nature of this path. The path usually ends in conservative management options, such as expectant or supportive management only or doing nothing. Such options are

![Figure 4. Circular path in the management of a patient losing bright red blood per rectum (BRBPR).](Image)

obviously available at the onset of many medical work-ups, especially in cases of incurable disease.

In the beginning, patients and physicians alike are often unable or unwilling to accept the sobering fact that little can be achieved by further medical intervention. They would rather gain comfort from having tried everything and tested even the remotest possibility to try to prolong life and reverse the disease state. By the nature of their trade, physicians may also be overly optimistic in assessing the probability of potential diagnostic and therapeutic alternatives. Lastly, legal liability and the need to practise defensive medicine drive physicians towards exhaustive low-yield work-ups. Many diagnostic procedures are scheduled to rule out contingencies with probability values of less than 1%. In a fee-for-service payer system, there is, on the one hand, a financial incentive for the physician to conduct extensive work-ups. On the other hand, given the medico-legal climate, there is an enormous personal financial disincentive to ignore even remote clinical possibilities. The disadvantages of putting the patient through a circular path relate to the hazards and side-effects associated with multiple invasive medical tests. The patient is exposed to time-consuming and strenuous procedures with ultimately no therapeutic benefit. The medical system as a whole is burdened by costly and ineffectual interventions.

In clinical routine, the circular pattern of medical management is often far from obvious. If the management plan is drawn out and takes a long time to complete, sight of its circular nature is easily lost. Similarly, if the individual patient is cared for, not by a single physician, but by many different specialists and sub-specialists, no real appreciation of the circular pattern of the overall process occurs. The actual circle often lies hidden amongst a multitude of medical outcomes and decisions that obscure its presence. In a hectic and time-constrained medical environment, there may be little free time to take a reflective moment, and to look back and realize that a long distance has been covered only to reach a point that was passed some time ago. Lastly, many patients with advanced or end-stage disease do not complete their passage of the circle but die on their way towards the elusive therapy.

What can be done to avoid circuitous medical management plans? In many instances, probably very little, and circular transitions may be unavoidable. All costs and benefits of medical interventions are weighted with the probability of their occurrence, and it is often difficult, if not impossible, to state up front the exact probability value of each potential outcome. It is then necessary to take a given path and test where it leads, before a statement about its actual value can be made. Physicians cannot afford to give up too easily and resort to supportive management only if there is a true chance for disease reversal or a substantial gain in lifetime. On other occasions, however, it is quite clear from the onset that a particular probability for success is slim. A simple outline of the management plan and the elimination of paths with low a priori probabilities would help to prevent unnecessary medical interventions. Such mental simulations would be especially helpful in patients who are asked to circle along the same management plan more than once, as in the example of gastrointestinal bleeding. Other examples relate to the repetitive work-ups of gastrointestinal symptoms associated with chronic pancreatitis, functional dyspepsia or diarrhoea. The awareness that previous management efforts have led to a circular path will help to prevent the same mistake being made. The physician may realize that it does not matter how he/she proceeds, because he/she will reach the same conclusion and return to the same decision point no matter what. Standing still and waiting then become as effective and less costly than a lengthy circular passage.

REFERENCES