Clinicopathological examinations are an important component of the investigation of intestinal disease, but are no substitute for a thorough clinical examination and adjunctive diagnostic imaging techniques are generally required to reach a definitive diagnosis. Rectal examination may allow palpation of neoplasms, abscesses or thickened intestine. Ultrasonographic examination may provide evidence of peritoneal effusion, intestinal thickening, diffuse pathology of parenchymatous organs or the presence of neoplasms or abscesses. Gastroscopic examination may provide evidence of equine gastric ulcer syndrome or (rarely) gastric neoplasia. Gastroscopy also provides a means of examining and biopsying the duodenum.

**ORAL GLUCOSE ABSORPTION TEST**

The OGAT is a valuable test for the detection of small intestinal malabsorption syndromes. This test has no relevance to large intestinal disease such as parasitism. A version of an OGAT can be used for the assessment of insulin resistance (see chapter on endocrine laminitis) however the sampling protocols are different and should not be confused.

### Performing an OGAT

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12 hour fast prior to testing (allow water)</td>
</tr>
<tr>
<td>2</td>
<td>Take ‘baseline’ oxalate-fluoride blood sample</td>
</tr>
<tr>
<td>3</td>
<td>Give 1g/kg glucose as warm 20% solution by stomach tube Take oxalate-fluoride bloods hourly for 5-6 hours or until there is a return to baseline (or just once at 2 hours gives reasonable accuracy)</td>
</tr>
<tr>
<td>4</td>
<td>Analyse samples for glucose and calculate percentage increases above baseline</td>
</tr>
</tbody>
</table>

### Interpretation

‘Normal’ response is an approximate doubling of baseline blood glucose at 2 hours post-dosing. However, severely hypoalbumenaemic (<15 g/L) cases may have depressed peaks in the absence of small intestinal pathology possibly as a result of bowel oedema. Often therefore, normal horses peak between 90-150 minutes and the peak may only be 60-70% above baseline. A normal response is quite reassuring of small intestinal absorptive function.

A ‘partial malabsorption’ (15-65% rise) is often significant and merits a retest at a later date.

A ‘total malabsorption’ is regarded as a no greater than 15% rise in blood glucose at 2 hours post-dosing. This is almost always a highly significant finding leading to a poor prognosis although occasional cases of total malabsorption have been known to improve.
PERITONEAL FLUID ANALYSIS

### Performing an abdominocentesis

- Insert a 2 inch, 19 gauge needle through the lowest point of the linea alba or just to the right of midline. (Some prefer to use a blunt-ended teat cannula and a small stab incision to perform this procedure).

Common reasons for failure to collect a peritoneal tap include:

- dehydration (whereupon successful taps are usually obtained following rehydration and fluid therapy), splenic tap (ultrasonography will identify the position of the spleen and allow repositioning of the peritoneal tap site), deep retroperitoneal fat layers (which can be up to 10 cm thick and occasionally require a spinal needle to obtain a tap and this can again be predicted on the basis of abdominal ultrasonography).

- Prior ultrasound examination maximises the chances of successful collection

### Interpretation

Normal peritoneal fluid has a total nucleated cell count of \(<5 \times 10^9/L\) (with approximately two-thirds of the cells being PMNs) and a total protein concentration of \(<20\text{g/L}\). Peritoneal fluid glucose concentration is normally slightly greater than blood glucose in the range of 4-7mmol/L. With septic peritonitis cell counts are generally \(>50 \times 10^9/L\) and total protein concentration \(>50\text{g/L}\). Glucose is metabolised by bacteria and concentration decreases to \(<2\text{mmol/L}\). Borderline total nucleated cell counts around \(5-10 \times 10^9/L\) represent a modified transudate and are more difficult to interpret but infer intra-abdominal disease. Intra-abdominal neoplasia in horses is rarely specifically identifiable by a peritoneal tap and exfoliated neoplastic cells. However, mild to moderate increases in total nucleated cell counts and protein concentrations are often found though they may be confused with low-grade septic peritonitis or equine grass sickness. Horses with inflammatory bowel disease and other causes of hypoalbuminaemia with peritoneal effusions may have dilute peritoneal fluid with low cell counts and protein concentrations.

### TISSUE BIOPSY

The site for biopsy may well depend on the clinical presentation and whether disease of large or small intestine is suspected to be predominant.

#### Rectal biopsy

This is undoubtedly the easiest and most accessible part of the gastrointestinal tract but is only likely to be pathologically affected in cases showing signs of distal intestinal tract disease (i.e. diarrhoea). In the absence of diarrhoea it is questionable whether this test is justified. It is easy and relatively safe to perform with light sedation and preferably in stocks. Although pathologic change is fairly commonly found in rectal biopsies taken from cases of chronic weight loss and diarrhoea, the changes are often highly non-specific and sometimes quite misleading. Overall there is a fairly poor correlation between rectal biopsy findings and intestinal pathology confirmed later at postmortem. Nevertheless, it is a simple and straightforward test to use and is certainly justifiable in many cases.

### Performing a rectal biopsy

Biopsy forceps are the best and most appropriate tool with which to collect the rectal biopsy although beer bottle caps have been used by pinching the mucosa between the cap and the thumb. The site to choose is in the dorsal midline. Some prefer to take a true rectal biopsy with the hand inside the rectum no more than “wrist deep”, others prefer to take a colonic biopsy by performing the biopsy at full arm’s length. Whilst the latter technique may give results that are more representative of the large intestine, any inadvertent penetration through the rectum is likely to result in intraperitoneal rather than retroperitoneal infection. The biopsies should be placed in 10% formalin for histopathologic analysis and/or cultured for enteropathogenic bacteria such as Salmonellae.
INTESTINAL BIOPSIES

There are three methods for taking small intestinal biopsies:

Duodenal pinch biopsies can be taken via duodenoscopy by passing a gastroscope through the stomach and pylorus. The resultant samples are superficial mucosal biopsies that are often damaged by crush artefact in the collection procedure. However, they are relatively simple to take and can sometimes be diagnostic in suspected small intestinal disease especially if grossly abnormal mucosa is identified endoscopically.

Laparoscopic full thickness biopsies may be collected from the small intestine in the standing sedated horse.

Full thickness biopsies from all levels of the intestinal tract may be collected via laparotomy under general anaesthetic. Exploratory laparotomy also enables thorough examination of the intestinal tract and whilst it is the most invasive technique in most cases it offers the best chance of achieving a definitive diagnosis.

DIAGNOSIS OF PARASITISM FROM BLOOD SAMPLES??

Nematode infections in the adult horse were once typified by intra-luminal adult worms and intra-arterial larval migration associated with *Strongylus vulgaris*. These were often associated with an eosinophilia detectable in blood samples in response to intra-arterial larvae and also, in some instances, a detectable increase in 1-globulins (especially IgG(T)). *S. vulgaris* has declined (almost to the point of extinction) and cyathostomins now account for virtually (if not all) nematode eggs detected in equine faecal samples in this country. Cyathostomin infection results in encystment of larvae locally in the caecal and colonic wall but is not associated with larval parasitic migration outside the intestinal tract. An eosinophilia is not associated with cyathostomin infections and a raised β1-globulin fraction is a very occasional and non-specific finding.

Several research studies have failed to confirm any clinically useful relationship between serum protein electrophoresis and parasitism in horses. Normal concentrations of IgG(T) and β1-globulins are usually found in parasitised adult horses and ponies although changes may be more likely in young horses. In an investigation of horses with chronic diarrhoea, less than half of horses with parasitic diarrhoea had raised β1-globulins and this finding was also common in horses with non-parasitic disease. ‘Cyathostominosis’, the acute diarrhoea and weight loss syndrome associated with en masse larval emergence, is consistently associated with a neutrophilia, hypoalbuminaemia and hyperfibrinogenaemia (all non-specific findings). Blood samples taken from parasitised horses show no consistent abnormalities in haematology or protein analyses therefore and are only one piece of the diagnostic jigsaw.