by permanent magnets since the strong magnetic field required for capsule manipulation interferes with currently available localization techniques. We have developed a novel wireless real-time pose detection module that is compatible with magnetic manipulation of wireless capsules based on permanent magnets. Aim: To characterize the localization profile of a magnetically manipulated wireless endoscopic capsule using the novel real-time pose detection system. Methods: The novel pose detection system consists of a localization module placed onboard a commercially available wireless capsule. The localization module measures the magnetic field generated by an external magnet and the absolute inclination of the capsule. The localization algorithm combines a pre-calculated magnetic field map with multiple sensor readings from an accelerometer and 6 magnetic field sensors. Thus, it is possible to extract the capsule position in terms of x, y, z and spatial orientation as pitch, yaw and roll. Using a passive tri-dimensional joint and two permanent magnets, one embedded within the pose detection system and the other held by a robotic manipulator, the proposed approach was compared to an optical tracker that served as the reference standard. Results: In reference to the optical tracker, within a spherical workspace of 30 cm diameter, the system provided an average localization error of x: 3.4±3.2 mm, y: 3.2±5.2 mm, z: 3.4±6.3 mm, pitch: 5±18 degrees, yaw: 3±20 degrees, and roll: 12±45 degrees. The localization algorithm was successfully able to localize a point within the capsule volume with an average computational time of 10±3 milliseconds. Conclusions: The novel real-time pose detection system was successful in characterizing the position and orientation of the wireless capsule. The system is compatible for use with external permanent magnet locomotion devices and the computational time is comparable to real-time robotic control systems. The level of position and orientation precision achieved by the novel system will allow for successful implementation into a closed-loop control module in capsule endoscopy.

## Sa1623

### Capsule Endoscopy in the Octogenarian: Equally Safe Compared to the Younger. Results From a Comparative Study

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Background: The rising number of geriatric patients has led to an increase in the use of capsule endoscopy (CE) for the evaluation of obscure gastrointestinal bleeding. There is limited published data on the safety of CE in patients particularly over the age of 80. Aim: To compare the proportion of CE patients who experienced a complication (either capsule retention or aspiration) between patients of age 80 and older and patients younger than 80. Secondary aims were to summarize the diagnostic yield and compare the completion rate in capsule endoscopy between these two age groups, as well as estimate the proportion of patients who had complimentary findings on CE and double balloon enteroscopy (DBE). Methods: Between January, 2005 and December 2011, 195 patients of age 80 and older underwent CE at a single tertiary referral center. These patients were matched in a 1:3 fashion to patients younger than 80 who underwent CE. Information regarding indication for CE, small bowel preparation, complications, completion and findings on CE, and agreement with findings on DBE in patients who underwent DBE following CE, was collected. Results: A summary of characteristics and findings on capsule endoscopy are summarized in Table 1 for the two age groups. A total of 143 patients (73%) >=80 years old had at least one finding, compared to 322 patients (55%) in the <80 age group. A comparison between the two age groups regarding the primary endpoint of complications and the secondary endpoints of CE completion and agreement between CE and DBE findings is provided in Table 2. Complications occurred at a similar though slightly lower frequency in patients >=80 years old compared to those <80 years of age (2.1% vs. 3.8%, P=0.36). All complications were related to capsule retention, with no study patients experiencing aspiration. A summary of the different resolutions of capsule retention is also shown in Table 2. Capsule endoscopy completion also occurred similarly in both age groups (82% vs. 83%, P=0.66). Of the 195 patients in the >=80 age group, 79 (40.5%) underwent DBE following CE, while 175 of the 585 patients (29.9%) in the <80 age group underwent DBE following CE. In these patients with DBE following CE, agreement regarding findings on the two procedures occurred at a similar high frequency in the >=80 and <80 age groups (89% vs. 86%, P=0.69). Conclusion: Complications resulting from CE occur at a similar frequency in patients >=80 years old compared to those younger than 80. Furthermore, with similar completion rate and high level of agreement between findings on capsule endoscopy and DBE when compared to the younger patient population, CE can be performed safely and with great diagnostic value in the octogenarian patient population.

**Table 1. Patient characteristics and findings on capsule endoscopy**

| Variable | Age >= 80 (N=195) | Age < 80 (N=585) | P-value |
|---|---|---|---|
| Gender (Male) | 108 (55.4%) | 324 (55.4%) | N/A |
| Small Bowel Preparation | | | 0.66 |
| Adequate | 183 (94.8%) | 542 (95.6%) | |
| Inadequate | 10 (5.2%) | 25 (4.4%) | |
| Primary Indication | | | <0.001 |
| Obscure gastrointestinal bleeding | 173 (88.7%) | 368 (62.9%) | |
| Abnormal imaging | 1 (0.5%) | 16 (2.7%) | |
| Diarrhea | 10 (5.1%) | 53 (9.1%) | |
| Suspected/Established IBD | 4 (2.1%) | 55 (9.4%) | |
| Nausea/vomiting or abdominal pain | 7 (3.6%) | 93 (15.9%) | |
| Findings | | | |
| Any findings | 143 (73.3%) | 322 (55.0%) | |
| Finding category | | | |
| Vascular lesion or angiodysplasia | 69 (35.4%) | 110 (18.8%) | |
| Ulceration or erosion | 27 (13.9%) | 88 (15.0%) | |
| Mass or polyp | 18 (9.2%) | 53 (9.1%) | |
| Other | 69 (35.4%) | 135 (23.1%) | |

IBD= inflammatory bowel disease. P-values results from Fisher's exact test. Information was unavailable regarding bowel preparation for 20 patients.

**Table 2. Comparison of complications, capsule endoscopy completion, and agreement between findings on capsule endoscopy and double balloon enteroscopy between >=80 and < 80 age groups**

| Variable | Age >= 80 (N=195) | Age < 80 (N=585) | P-value |
|---|---|---|---|
| Primary endpoint | | | |
| Complication | 4/195 (2.1%) | 22/585 (3.8%) | 0.36 |
| Secondary endpoints | | | |
| CE completion | 160/195 (82.1%) | 488/585 (83.4%) | 0.66 |
| Agreement between CE and DBE findings in patients with both procedures | 70/79 (88.6%) | 150/175 (85.7%) | 0.69 |

| Resolution of capsule retention | Age >= 80 (N=4) | Age < 80 (N=22) |
|---|---|---|
| Capsule retained in stomach but eventually passed | 2 (50.0%) | 17 (77.3%) |
| Capsule removed surgically | 2 (50.0%) | 1 (4.5%) |
| Capsule retrieved during double balloon enteroscopy | 0 (0.0%) | 4 (18.2%) |

CE=capsule endoscopy. DBE=double balloon enteroscopy. P-values result from fisher's exact test.

## Sa1624

### Effect of Long-Term PPI Administration on NSAID-Induced Small Intestinal Lesions and Therapeutic Effect of Irsogladine, a Gastroprotective Drug, for Such Lesions in Healthy Volunteers

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Background: Proton-pump inhibitors (PPIs) such as omeprazole are a standard treatment to prevent non-steroidal anti-inflammatory drugs (NSAIDs)-induced upper gastrointestinal mucosal injuries. However, it is unclear how small intestinal injuries are affected by long-term administration of PPIs and NSAIDs. Therefore, we investigated small intestinal lesions induced by 10 weeks' concomitant use of PPIs and NSAIDs in healthy volunteers. Moreover, we also examined the therapeutic efficacy of irsogladine for such lesions. Aim: Our purpose is to assess the change of small intestinal lesions induced by NSAIDs and PPI over time and the efficacy of irsogladine on such lesions. Method: Thirty seven healthy subjects were enrolled in this study. In NSAID+PPI (n=21), subjects received NSAID (diclofenac sodium, 75 mg/day) and omeprazole (10mg/day) for 6 weeks. After the treatment, some subjects in NSAID+PPI group took the same NSAID+PPI medication, and others received irsogladine in addition to NSAID+PPI from week 6 to week 10. In NSAID+irsogladine group, subjects received NSAID and irsogladine(4 mg/day) for 6 weeks. Capsule endoscopy was administered before the treatment and 2, 6 and 10 weeks after treatment. Results: The number of mucosal breaks in NSAID+PPI group at week 2 was significantly greater than that at week 0. Although the number of mucosal breaks in NSAID+PPI treatment at week 6 was significantly larger than that at week 0, that at week 6 was decreased compared to that of at week 2. Meanwhile, the number did not change between at week 6 and at week 10 in

the NSAID+PPI treatment. However, addition of irsogladine at week 6 significantly reduced the number of such lesions at week 10. In NSAID+irsogladine group, the number of mucosal breaks was significantly smaller than that at week 2 and 6 compared to NSAID+PPI group. Conclusions: In concludion, long-term PPI administration did not show any preventive efficacy for small intestinal lesions induced by NSAIDs although it is a standard medication for NSAIDs induced gastrointestinal lesions. Small intestinal lesions at week 6 are less severe as compared to those at week 2 by small intestinal mucosal adaptation. On the other hand, irsogladine prevented small intestinal lesions by NSAIDs and showed therapeutic benefit for such lesions achieved with NSAIDs and PPIs.

**Sa1625**

**The Evaluation of Portal Hypertensive Enteropathy Using Capsule Endoscopy in Cirrhotic Patients: a Multicenter Study**

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Background/aims: Portal hypertensive enteropathy (PHE) in cirrhotic patient with portal hypertension (PH) isn't well known, and there is a limited data available on PHE. Therefore, the aim of this study was to determine the prevalence of PHE by capsule endoscopy (CE) and to evaluate the clinical characteristics of related factors in these patients. Methods: We used the Capsule Endoscopy Nationwide Database Registry to identify cirrhotic patients with PH who underwent CE from October 2002 to May 2012. A total of 45 CE examinations were performed for cirrhotic patients with PH. PH was diagnosed by endoscopic or radiographic evidence. In CT finding, the secondary change due to PH comprised six items. These findings were scored, and the scores were then resulting in a total score of 0 to 6. PHE was defined as mucosal inflammatory-like abnormalities (grade I), and/or vascular lesions (grade II). We retrospectively compared 18 patients with and 27 without PHE. Results: Of 45 patients (33 men; mean age 56.7 years), obscure gastrointestinal bleeding was the most common indication (overt vs. occult = 80% vs. 15.6%). PHE was identified in 40% (18/45) and the grade II was detected in 77.7% (14/18). The lesions included angiodysplasias in 55.5% (10/18) and varices in 38.8% (7/18). Active bleeding was seen during CE in 16.6% (3/18). In patients with PHE, the mean Hb level was 7.5±1.8 g/dL and Child-Pugh class C was 33.3% (6/18). Portal hypertensive gastropathy (PHG) and portal hypertensive colopathy (PHC) were detected in 50% (9/18) and 27.8% (5/18), respectively. The treatment such as radiologic, endoscopic and surgery was conducted in 38.9% (7/18). A comparison of patients with and those without PHE showed that Child-Pugh class C cirrhosis ($p = 0.002$) and high CT score (1.8±1.4 vs. 1.0±0.8, $p=0.027$) were significantly associated with PHE. The presence of PHE was not related gender, the etiology of cirrhosis, previous bleeding history, larger esophageal varices, PHG and PHC. Conclusions: PHE may be more prevalent in cirrhotic patients with PH that exhibit Child-Pugh class C or a high CT. Although additional prospective and larger studies are needed, CE could be useful diagnostic method of evaluating PHE in cirrhotic patients.

**Sa1626**

**Evaluation of the Capsule 3D LOG Function of the Olympus EC-10 Video Capsule**

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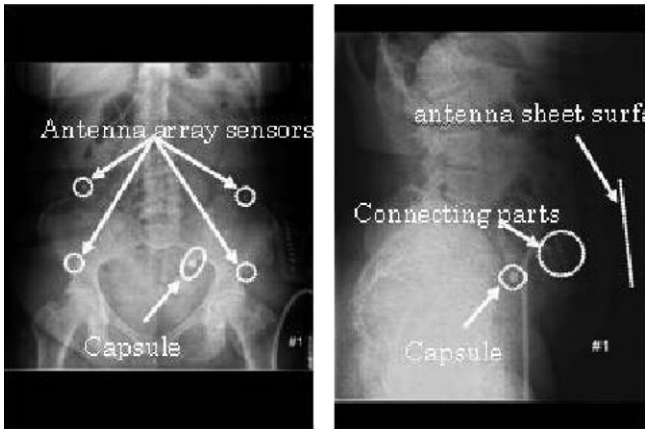
Background: Video capsule endoscopy has become the primary endoscopic means of examining the small bowel and defining pathological lesions. However localization of a specific lesion remains largely guesswork, and is based on the transit time taken between the pylorus and ileo-cecal valve. We report the validation of new three-dimensional localization software utilized by the EC 10 capsule, developed by Olympus Corp. using radiological localization in volunteers. Methods30 volunteers with no known prior history of gastrointestinal disease swallowed the EC-10 video capsule. A sensor array with six radiopaque markers was placed on the anterior abdominal wall. Once the capsule was visualized to be in the small intestine using a real time viewer, five sets of much lower than standard dose anterior-posterior and lateral digital x-rays were taken every thirty minutes. Distances between the sensor points and the capsule were measured on the x-rays to provide X, Y, and Z coordinates and compared with the distances calculated by the software from the same points. The time of ingestion of the capsule and the x-rays were synchronized. Results: Data from 27 of the 30 subjects were suitable for analysis. There were three technical failures. Our study evaluated the accuracy of the "Capsule 3D Log function" which calculated the capsule position based on the signal strength received at the sensor array. The accuracy of the position was compared to the actual position of the capsule as determined by digital radiographic images obtained during the capsule's transit through the small bowel. We obtained measurements from 128 radiographic sets from 27 subjects. It was determined that in 88% of the radiograph sets, the video capsule was within 2- 6 cm of the predicted position (in all three spatial coordinates) provided by the Capsule 3D log function. The volunteers were selected to provide a range of BMI scores [<18 to >40] in accordance with the published figures for the distribution of BMI in the general population.. There was no correlation between accuracy of measurements and the BMI score. Conclusion: Correlation between the radiological measurements and those calculated by the software was within the range of 2 to 6 cm. The validity of this range now requires testing prospectively in patients with pathological lesions.




**AP and Lateral films demonstrating sensor array and capsule.**

**Sa1627**

**Prophylactic Effect of Egualen Sodium Hydrate on Small-Intestinal Mucosal Damage Induced by Low-Dose Aspirin in Healthy Subjects. : a Prospective Randomized Clinical Trial**

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Introduction: It is known that non-steroidal anti-inflammatory drugs (NSAIDs) may induce mucosal damage in the small intestine as well as the stomach; however, many aspects of its pathological conditions, mucosal damage and how to cure or prevent it are not well known. With regard to non-aspirin NSAIDs, the mechanism whereby such a drug induces mucosal damage, and how to prevent it, are becoming clearer as a result of animal experiments. On the other hand, for aspirin, it is difficult to conduct basic research with animals, and many aspects of the mechanism whereby it induces mucosal damage have not been made clear. We studied the preventive effect of egualen sodium hydrate, which is a gastroprotective agent that suppresses small-intestinal damage induced by indomethacin in rats, against small-intestinal mucosal damage induced in humans by low-dose aspirin. Subjects and Methods: (1) Rats were given one p.o. doses of egualen before and after the s.c. indomethacin injection. The injured area of the small intestine was analyzed. In addition, we evaluated the drug distribution of egualen on small intestinal mucus. (2) The subjects were healthy male adult volunteers (each group: n=10). we randomly divided them into aspirin 100mg plus placebo daily group (A), aspirin 100mg plus egualen 1.2g daily group (B). We examined the subjects using capsule endoscopy, and fecal occult blood testing after two weeks of administration of the respective drugs. We assessed intestinal mucosal damage observed by capsule endoscopy according to the following grades: erythema, erosion, ulcers, and edema. Results: (1) Egualen significantly ameliorated indomethacin-induced small intestinal injury and were uniformly spread to jejunum, ileum, and ileum terminal. (2) On