The Use of Radioactive ^{51}Cr in Measurement of Intestinal Blood Loss*

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=國文抄錄=

^{51}Cr 을 使用한 腸管內 出血量測定法

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緖 論

胃腸管內의 出血의 有無를 診斷한다는 것은 臨床的으로 大端히 重要하며 潛血反應은 臨床檢出法의 하나로 많이 利用되고 있다. 潛血反應에 使用되는 各種化學反應은 그 檢出法이 比較的 簡便하되 出血量을 推定 하는것은 困難하여 定性反應의 領域을 벗어나지 못하고 있다. 特히 우리나라에는 消化管內의 出血을 惹起하기 쉬운 胃潰瘍, 十二指腸潰瘍 乃至 胃癌과 같은 各種 疾患의 罹患率이 많을 뿐만 아니라 十二指腸虫 感染者가 많아 出血量의 測定은 各種疾患의 治療方針乃至 豫後를 決定하는데 大端히 重要하다.

最近 放射性「크롬」(^{51}Cr)으로 標識된 赤血球를 靜注한 後 大便內에 排泄되는 放射能을 測定하여 末梢血液單位量內의 放射能과 比較하여 消化管內의 出血量을 測定하는 硏究가 報告되고 있다.

著者는 出血量이 赤血球壽命測定에 미치는 影響을 觀察하는 豫備實驗의 하나로 從來 ^{51}Cr 를 使用한 消化管內의 出血量測定法에 對한 몇가지 基礎的 硏究를 試圖하여 ^{51}Cr 法의 信憑性如何를 檢討한 바 있어 이에 報告하는 바이다.

實驗方法 및 實驗對象

I) 放射性「크롬」(^{51}Cr)과 赤血球의 標識法：

原子力硏究所에서 生産된 $Na_2{}^{51}CrO_4$를 使用하였고 標識法은 赤血球壽命測定때와 같은 方法(Gray & Sterling, Read)을 使用하였다.

靜注된 ^{51}Cr 의 排泄 및 經口投與한 ^{51}Cr 의 吸收度를 觀察하기 爲하여 다음과 같은 豫備 實驗을 하였다.

^{51}Cr 로 標識된 一定量의 赤血球를 Levine tube 를 使用하여 被檢者의 十二指腸部位에 正確히 全量을 注入시킨다음 tube 속의 ^{51}Cr 放射能을 없애기 위하여 약 100 ml 의 水道물로 洗滌한다음 24時間 後부터 大便, 尿 및 血液을 每日採取하여 ^{51}Cr 의 放射能을 測定하여 投與한 ^{51}Cr 에 對한 百分率을 算出한다. 大便 및 尿의 採取는 그속의 放射度를 測定할 수 없을때 까지 實施한다(大略 7～10 日間). 수집한 大便은 900～1,000°C 의 電氣爐속에서 소각 하여 完全 灰化시킨다음 一定量의 蒸溜水로 稀釋한 다음 well 型 scintillation counter 로 ^{51}Cr 의 放射度를 計測하고 血液量으로 換算한다.

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尿는 24時間 尿를 全部 蓄尿한 다음 3~5 ml의 試料를 採取하여 放射度를 測定하고 1日 尿中의 ^{51}Cr 排泄量을 計算하는 한便 血液量으로 換算한다.

血液量의 測定：

赤血球壽命測定때와 같은 方法으로 處理하여 靜注한 後 10分 20分 乃至 30分 後에 heparin을 添加하여 2~4 ml 可量 採血하고 그 放射度를 測定하여 그 平均値를 求한다.

實 驗 成 績

^{51}Cr의 大便 및 尿中 排泄을 觀察하는 한편 投與한 血液量(^{51}Cr로 標識된)과의 相互關係도 아울러 考察할 目的으로 投與血液量을 달리하는 條件下에 實施한 成績을 보면 다음과 같다. 即

1) ^{51}Cr 標識赤血球의 經口投與後의 大便 및 尿中에의 ^{51}Cr 回收率 및 排泄率：

^{51}Cr 標識赤血球 5 ml, 10 ml, 15 ml 및 20 ml를 各各 潛血反應이 陰性인 正常 健康人 3名 乃至 5名에게 十二指腸管內에 注入한 後의 大便內의 ^{51}Cr 回收率과 腸管內吸收率(尿中排泄量)을 보면 Table 1, 2 및 3에서 보는 바와 같다. 即

5 ml式 注入한 檢査群(A)에서는 大便內의 ^{51}Cr 回收率은 85.7~90.7%, 平均 87.8%이고 尿中排泄量은 0.5~1.2%, 平均 0.8%로 總回收率은 86.7~91.4%, 平均 88.5%이었고 10 ml式 注入한 檢査群(B)에서는 大便속의 ^{51}Cr 回收率은 87.5~92.5%, 平均 90.0%, 尿中排泄量은 0.5~1.5%, 平均 0.9%로 總回收率은 88.2%~94.0%, 平均 90.9%이었다. 한便 15 ml 乃至 20 ml式 投與한 檢査群(C)에서는 大便속의 ^{51}Cr 回收率은 89.7~97.7%, 平均 94.3%, 尿中排泄量은 0.5~1.2%, 平均 0.8%로 總回收率은 95.1%이었다.

2) ^{51}Cr 標識赤血球의 靜注後의 腸管內排泄：

^{51}Cr 標識赤血球를 靜注하면 ^{51}Cr의 大部分은 尿中으로 排泄됨이 알려져 있으나 그 以外의 排泄經路에 關하여는 그다지 알려져 있지 않다.

潛血反應이 陰性인 正常健康人 5例에게 ^{51}Cr 標識赤血球 15 ml를 靜脈注射한 後 經時的으로 唾液, 胃液, 十二指腸液 및 大便을 採取하였다.

唾液, 胃液 및 十二指腸液(A-膽汁 및 B-膽汁으로 區別하였음)을 各各 2~5 ml式 採取하였고 大便은 4~5日間(便秘時에는 7~10日間까지)採取 電氣爐로 灰化하여 各各 그의 放射能을 計測하였고 大便속의 ^{51}Cr 放射度는 血液量으로 換算하였으며 그 成績은 Table 4에서 보는바와 같다. 即 唾液이나 B-膽汁속에서는 거의 ^{51}Cr 放射能을 發見할 수 없었는데 反하여 胃液 및 膽汁 A속에서는 靜注 1~2日 以內에 若干의 放射能을 檢出할 수 있었다.

한편 大便속에서는 1日 0.5 乃至 1.5 ml의 血液에 해당되는 ^{51}Cr의 放射能을 관찰할 수 있었으며 이 程度(平均 0.9 ml/血液/日)의 ^{51}Cr의 便中 出現은 眞性出血과는 無關한 것으로 생각된다.

總　　括

Owen[1,2]等은 2匹의 개에서 $Na_2{}^{51}CrO_4$로 標識한 赤血球를 胃內에 注入하여 거의 大部分이 大便으로 排泄되는 한便 靜注로 注入한 ^{51}Cr의 大部分은 尿中으로 排泄됨을 發表하였고 그 후 Roche[3]等은 ^{51}Cr 標識赤血球를 十二指腸管內에 注入한 8例에서 尿中排泄은 1.7%(0~5.3%), 便中 回收率은 96.7%(90.7~103.5%), 總排泄率은 98.7%(91.5~105.7%)라고 報告한바 있다.

著者의 成績을 보면 投與한 血液量이 많을수록 大便속의 回收率은 높으며(Fig. 1) 大便속의 銳敏하고 높은 回收率을 얻고저 할때에는 적어도 15 ml 以上의 赤血球를 投與함이 妥當함을 알 수 있었다. 經口投與後의 ^{51}Cr의 胃腸管吸收率(尿中排泄)을 보면 大體로 1%以內(0.8~1.5%)이며 投與血液量과는 無關함을 알 수 있었다. 한便 ^{51}Cr의 靜注後에는 大部分이 尿中排泄의 經路를 取하되 膽管內의 出血量을 이 方法으로 計測하고저 할때에는 腸管內의 chromium 排泄有無를 觀察함이 必要하다. 潛血反應이 陰性인 正常健康人에게 ^{51}Cr 標識赤血球를 靜注하였을때 大便속에서 出血과 關係없는 ^{51}Cr의 放射能을 計測할 수 있으며 이때의 ^{51}Cr의 放射能을 血液量으로 算出한 硏究들이 報告되고 있다. 即 Roche[3]等은 正常人에서 1.27 ml/d, Ebaugh[4]等은 0.3~2.0 ml/d, Hughes-Jones[7]는 2 ml/d 以下의 出血

을 볼 수 있었다고 하고 Nakao는 1.0 ml 前後의 血液에 해당되는 出血을 보았다고 한다. 著者는 平均 0.9ml의 血液에 해당되는 出血과는 全然 無關한 ^{51}Cr의 放射能을 發見할 수 있었다. 靜注投與時의 尿中 以外에 ^{51}Cr 排泄의 經路를 관찰하기 위하여 經時的으로 胃液, 唾液 및 十二指腸液(A 및 B 膽汁으로 區別)을 採取하여 그속으로 排泄되는 ^{51}Cr의 放射能을 測定해본 즉 注入初期에 胃液 및 A膽汁속에서 若干의 放射能을 發見할 수 있었으며 上述한 出血과 無關係한 ^{51}Cr의 使用排泄은 主로 膽汁 및 胃液을 通한것이 아닌가 생각된다.

結　　論

$Na_2{}^{51}CrO_4$를 使用하여 赤血球를 標識靜注한 후 大便속으로 排泄되는 放射能을 測定하여 消化管內의 出血量을 測定하는 方法에 關한 基礎的 臨床實驗을 하여 다음과 같은 成績을 얻었다.

1. 潜血反應의 陰性인 正常健康人 16例에서 ^{51}Cr 標識赤血球를 經口投與하였을때 大便內의 平均 回收率은 90.7%(85.7~97.7%)로 投與血液量이 많을수록 便中回收率은 높으며 따라서 檢查時에는 적어도 15 ml 以上의 血液을 使用함이 適當하다고 생각된다. 한便 이때의 尿中 排泄은 平均 0.8%(0.5~1.5%)이었다.

2. ^{51}Cr 標識赤血球를 正常健康人에게 靜注하였을때 ^{51}Cr의 放射能을 便속에서 檢出할 수 있었으며 血液量으로 換算하여 0.9 ml에 해당한다. 이 放射能은 出血과는 無關係하여 主로 A- 膽汁 및 胃液으로 排泄되는것으로 생각된다.

따라서 적어도 2.0 ml 以上의 血液量에 해당되는 ^{51}Cr의 放射能이 있을때 臨床的으로 意義가 있다고 본다.

INTRODUCTION

The measurement of gastrointestinal bleeding is often difficult. The evaluation of gastrointestinal bleeding by the usual chemical methods is of limited value from a quantitative standpoint. The guaiac test, which is the most commonly employed, may fail to identify small amount of gastrointestinal bleeding. The benzidine test, although more sensitive, may occasionally result in false positive.

In 1954, Owen and colleagues[1] first suggested the use of ^{51}Cr labeled red cells to evaluate patients with gastrointestinal bleeding. Subsequently, studies on the use of this method have been reported by Owen,[2] Roche[3] and Ebaugh,[4] and it is now an established means of determining the presence of blood in the stool, particularly in cases which other methods have failed.

PRINCIPLE

Erythrocytes can be readily tagged with ^{51}Cr (as for red blood cell mass and red cell survival studies) without significantly altering them. The patient's own red blood cells can be removed, tagged and reinjected; then collection and measurements of the amount of radioactivity in the stool can be employed to determine actual gastrointestinal bleeding.

A comparison with the amount of activity in a sample of the patient's blood can be also used to estimate the amount of gastrointestinal bleeding during a specific time period.

PRELIMINARY EXPERIMENTS

In order to employ ^{51}Cr method for the measurement of gastrointestinal hemorrhage, the following conditions should be met:

1. ^{51}Cr is not normally excreted into the feces from circulating erythrocytes in significant amount and
2. Provided ^{51}Cr is not reabsorbed from the intestine once it has reached that area.

The author has tried to obtain information through the preliminary experiment on;

1. How much ^{51}Cr is absorbed from the gastrointestinal tract when it is introduced into the stomach or duodenum of normal subjects and

2. What proportion of ^{51}Cr within the circulating red blood cells appear daily in the feces of normal subjects.

MATERIALS AND METHODS

Healthy medical students and medical doctors have been subjected to this study and all the subjects were free from hook-worm ova in at least 5 fecal examinations and negative in occult blood reaction (benzidine).

(1) Tagging of circulating erythrocytes:

Ascorbic acid technique which is usually applied in measuring the red cell survival time with ^{51}Cr has been employed for ^{51}Cr tagging in this experiment:

i) Obtain blood in a plastic or glass syringe by venepuncture and add 10 volumes of the blood to 1. 5 volumes of sterile acid-citrate dextrose solution.

ii) Add sterile $Na_2{}^{51}CrO_4$ slowly and with continuous gentle mixing of the blood. The administered radioactivity should be as low as possible, but in any case no more than 2 uCi/kg body weight. The isotope must have a specific activity such that less than 2 μg of chromium are used per ml of packed red cells. It should be in a volume of 0. 2~1. 0 ml. If necessary, to achieve this volume the solution of isotope should be diluted in sterile 0. 9% NaCl. This diluted isotope solution is then added to the blood using a sterile technique.

iii) Place in water bath at 37°C for 15 minutes.

iv) Add 100 mg of sterile ascorbic acid, mix well.

v) Sample is re-injected intravenously. Aliquot must be retained to prepare the appropriate standards to measure the blood volume.

vi) Collect blood samples from a vein opposite to that used for the injection by venepuncture, with as little stasis as possible.

(2) Study of ^{51}Cr absorption from the gastrointestinal tract:

Certain amount of ^{51}Cr tagged erythrocytes (more than 15 ml) has been introduced exactly into the duodenum of examinee via Levine tube and the tube was washed 5 or 6 times successively with 20~25 ml of water. The tube was removed after thorough cleansing and decontamination. Then, stool, 24-hour urine and venous blood were obtained daily and their radioactivities have been measured. Depending upon the state of bowel movement, the days required for disappearance of radioactivity in the stool were varied. In subjects with diarrhea, radioactivity disappeared within 3~4 days after administration and the activity could be measured up to 7~10 days in constipated subjects. In general, however, the stool has been collected for one week after administration. The results were expressed in terms of percent of the administered ^{51}Cr, except for the activity of blood, in which results were expressed in terms of counts per minute per milliliter of blood.

(3) Study of ^{51}Cr excretion from tagged circulating erythrocytes:

Certain amount of ^{51}Cr tagged erythrocytes has been injected intravenously and stool was obtained daily until the radioactivivity has been disappeared in collected feces. Saliva, gastric juice and duodenal juice were also obtained. In obtaining duodenal juice, particular attention was paid to differentiate A bile from B. Because of the unpleasantness of preparing and transferring fecal homogenates and the inefficiency of counting small aliquots in a well scintillation counter, the author has used gas-fired laboratory incinerator or electric incinerator recommended by Buchanan et al.[5] and Wagner.[6] After the samples were incinerated and were made constant in volume by adding 3 ml of distilled water, their radioactivities have been measured using well scintillation counter. The method is considerably more sensitive than counting of aliquots of homogenized feces, and most of the unpleasantness of sample method is eliminated.

The radioactivity of the fecal aliquot was compared with that of 3 ml of blood obtained from the patients. The results were expressed in terms of ml of blood with a radioactivity equivalent to that found in the stools during the period of study. Samples of heparinized whole blood were obtained on the first and the last day of collection period.

The percentage excretion is then determined by the formula:

$$\% \text{ excretion} = \frac{\text{Total cpm in stool}}{\text{Average cpm per ml. of circulating level on first and last day}}$$

Urine activity was measured in 3 ml of undiluted sample and the activity was compared with that of blood obtained on the same day.

RESULTS

In order to measure the excretion rate of ^{51}Cr in feces and urine, and to observe its relationship

Table 1. Per cent recovery in feces and excretion in urine of red cell labeled ^{51}Cr given by mouth (Group A)

Subject No.	Blood given	Hb (g/100 ml)	RBC (mill/mm³)	Hct (%)	Serum iron (μg/100 ml)	% recovery in feces	% recovery in urine	% recovery: % cumulation total
1	5	14.8	4.8	44	121.8	86.5	0.6	87.1
2	5	14.9	4.8	47	107.8	88.2	1.2	89.4
3	5	14.8	5.1	45	123.4	90.7	0.7	91.4
4	5	15.0	4.8	45	114.5	87.5	0.5	88.0
5	5	14.2	4.7	44	111.4	85.7	1.0	86.7
Average	5	14.7	4.8	45	115.8	87.8	0.8	88.5

Table 2. Per cent recovery in feces and excretion in urine of red cell labeled ^{51}Cr given by mouth (Group B)

Subject No.	Blood given	Hb (g/100 ml)	RBC (mill/mm³)	Hct (%)	Serum iron (μg/100 ml)	% recovery in feces	% recovery in urine	% recovery: % cumulation total
6	10	14.0	4.9	45	119.0	90.1	0.7	90.8
7	10	14.6	4.9	43	111.0	88.7	0.5	89.2
8	10	14.9	5.0	44	114.0	92.5	1.5	94.0
9	10	14.6	4.9	45	109.8	91.2	1.2	92.4
10	10	14.2	4.5	44	120.5	87.5	0.7	88.2
Average	10	14.5	4.8	44	114.9	90.0	0.9	90.9

Table 3. Per cent recovery in feces and excretion in urine of red cell labeled ^{51}Cr given by mouth (Group C)

Subject No.	Blood given	Hb (g/100 ml)	RBC (mill/mm³)	Hct (%)	Serum iron (μg/100 ml)	% recovery in feces	% recovery in urine	% recovery: % cumulation total
11	15	15.4	4.9	45	102.7	96.5	0.8	97.3
12	15	15.7	5.1	46	118.5	95.5	0.7	96.2
13	15	14.5	4.9	45	124.4	90.8	1.0	91.8
14	20	14.9	4.9	45	116.7	89.7	0.5	90.2
15	20	15.6	5.2	46	102.5	95.7	1.2	96.9
16	20	14.5	4.8	44	112.8	97.7	0.7	98.4
Average	17.5	15.1	4.9	45	112.9	94.3	0.8	95.1

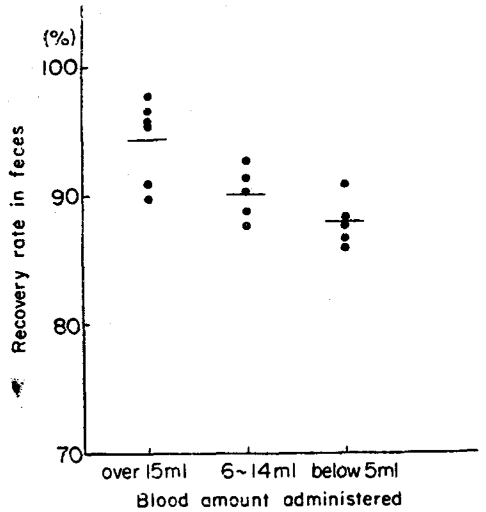

Fig. 1. Relationship between the amount of administered blood and recovery rate in feces.

with the administered ^{51}Cr tagged erythrocytes volume, the experiment has been undertaken under a different dosage of administration and the following results have been obtained.

(1) Recovery rate in feces and excretion rate in urine after the oral administration of ^{51}Cr tagged erythrocytes.

The recovery rate in feces and the excretion rate in urine, which is correspond to ^{51}Cr absorption from the gastrointestinal tract, have been measured after introducing 5 ml, 10 ml, 15 ml and 20 ml of ^{51}Cr tagged erythrocytes into the duodenum of 5 normal healthy subjects with negative occult blood reaction respectively. The results were shown in Tables 1, 2, 3 and Figure 1.

In Group A, where 5 ml of ^{51}Cr tagged erythrocytes were administered, the recovery rate in feces ranged from 85.7 to 90.7 per cent with an average of 87.8 per cent. The excretion rate in urine in the same group ranged from 0.5 to 1.2 per cent with an average of 0.8 per cent and the total cumulative rate ranged from 86.7 to 91.4 per cent with an average of 88.5 per cent.

In Group B, where 10 ml has been introduced, the recovery rate in feces was 90.0 per cent in average, ranging from 87.5 to 92.5 and the urinary excretion rate was 0.9 per cent in average, ranging from 0.5 to 1.2 per cent. The total cumulative rate was 90.9 per cent in average and it has ranged from 88.2 to 94.0 per cent.

In Group C, where 15~20 ml has been administered, the recovery rate in feces was 94.3 per cent, ranging from 89.7 to 97.7 and the urinary excretion rate was 0.8 per cent in average, raging from 0.5 to 1.2 per cent. The total cumulative rate was 95.1 per cent in average.

(2) ^{51}Cr excretion rate from gastrointestinal tract

Table 4. Excretion rate in salivary gland, gastric juice, duodenal juice, and feces of red cell labeled ^{51}Cr administered intravenously

Case No. / Time after dose (day)	Salivary gland					Gastric juice					Duodenal juice* A bile					Duodenal juice* B bile					Feces				
	(cpm/ml)—(background)																				(ml of "blood"/day)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	0	0	0	0	1	1	1	1	1	−1	1	−1	0	0	1	−2	−2	0	0	0	0.8	0.7	0.7	0.7	1.0
2	−2	1	−2	−1	0	−1	1	0	−1	−1	1	2	1	1	0	0	−1	−1	−1	−1	1.0	1.5	1.2	1.5	1.0
3	−1	0	−2	0	0	−1	−1	1	−1	0	−2	0	1	0	0	−2	0	−1	1	−1	1.2	1.2	1.5	1.0	1.2
4	0	−1	0	−2	−1	0	−2	−1	0	−1	−1	0	0	1	−1	−1	−2	0	0	0	1.5	0.7	1.0	0.7	1.0
5	0	−2	0	−1	−1	−1	0	0	0	0	0	0	−1	−2	0		0	0	0	0	0.6	1.0	1.2	0.7	0.8
6																					1.0	0.8	0.7	1.2	1.0
7																					0.5	0.6	0.6	0.5	0.6
Average																					0.9	0.9	1.0	0.9	0.9

after the intravenous administration of ^{51}Cr tagged erythrocytes.

It has been widely known that the majority of ^{51}Cr tagged erythrocytes administered intravenously excrete in urine. However, the other route of excretion is still remained unclear. The author has injected 15 ml of ^{51}Cr tagged erythrocytes intravenously to 5 normal healthy subjects, and collected 5 ml of saliva, gastric juice and duodenal juice to measure radioactivity with well type scintillation counter.

Stool was also collected for 4~7 days after injection and their radioactivities have been measured after incineration with electric furnace.

As shown in Table 4, ^{51}Cr radioactivity was not detected in saliva and B-bile, whereas the negligible amount of radioactivity was detected in gastric juice and A-bile within 1~2 days after injection. The radioactivity of collected stool was equivalent to 0. 9 ml of blood in average and it has ranged from 0. 5 to 1. 5 ml.

DISCUSSION

Owen, Bollman and Grindlay[1] (1954) have shown in two dogs that most of the ^{51}Cr-labeled erythrocytes placed into the stomach of these animals is recovered in the feces and most of excreted radioactivity from ^{51}Cr in circulating erythrocytes appeared in the urine, and they have suggested that marking circulating erythrocytes with ^{51}Cr and measuring stool and blood radioactivity comparatively would be a mean of determining the exact quantity of blood loss from gastrointestinal lesions. In a subsequent report, Owen and his colleagues[2] showed the validity of this method in clinical cases of portal cirrhosis with esophageal varices. In 1957, Roche et al,[3] Hughes-Jones,[7] and also Bannerman[8] confirmed the results in patients with anemia from chronic gastrointestinal bleeding.

Roche[3] reported that the fecal recovery of ^{51}Cr was 96. 7 per cent in man. In Hughes-Jones series,[7] six anemic patients were studied with this method and the estimated blood loss from the intestine correlated well with the rate of loss of ^{51}Cr from blood.

The author obtained the similar results through the present experiment and it has been understood that the amount of administered ^{51}Cr tagged erythrocytes should be more than 15 ml in order to obtain particularly high level of fecal recovery of ^{51}Cr. The absorption and excretion of ^{51}Cr through gastrointestinal tract should be small if this method being utilized for the detection of gastrointestinal hemorrhage.

Owen et al.[1] found that less than 0. 1 per cent of the injected radioactivity recovered in the feces per day, which was equivalent to less than 1 ml of blood and Roche et al[3] reported that there was little fecal excretion of radioactivity (average 1. 27 ml of "blood" per day) after administration of ^{51}Cr labeled erythrocytes. The radioactivity in the stool of normal person was reported as equivalent to 0. 3~2. 0 ml of blood per day by Ebaugh et al.[4] and as less than 2 ml of blood per day by Hughes-Jones et al.[7] The author has detected ^{51}Cr radioactivity in the stool of healthy subjects which is equivalent to 0. 9 ml of blood per day. The radioactivity of this grade in the stool seems to be not related with hemorrhage and the author has categorized as hemorrhage when the measured radioactivity is more than 2. 0 ml of blood per day. In order to investigate the origin of such a radioactivity in the stool which is not related to hemorrhage, we have collected gastric and duodenal juice along with saliva after the intravenous administration of ^{51}Cr tagged erythrocytes and their radioactivities were measured. We have detected radioactivity of low level in gastric juice and A-bile shortly after injection and we have postulated that the radioactivity in the stool not related to hemorrhage is probably originated from gastric juice and A bile.

SUMMARY

1. Sixteen normal healthy subjects free from occult blood in the stool were selected and administered with their ^{51}Cr labeled own blood via duodenal tube and the recovery rate of radioactivity in feces and urine was measured. The average fecal recovery rate was 90.7 per cent (85.7~97.7%) of the administered radioactivity, and the average urinary excretion rate was 0.8 per cent (0.5~1.5%)

2. There was a close correlation between the amount of blood administered and the recovery rate from the feces; the more the blood administered, the higher the recovery rate was. It was also found that the administration of the tagged blood in the amount exceeding 15ml was suitable for measuring the radioactivity in the stools.

3. In five normal healthy subjects, whose circulating erythrocytes had been tagged with ^{51}Cr, there was little fecal excretion of radioactivity (average 0.9 ml of blood per day). This excretion is not related to hemorrhage and the main route of excretion of such an negligible radioactivity was postulated as gastric juice and bile.

4. A comparison of the radioactivity in the blood and feces of the patients with ^{51}Cr labeled erythrocytes seems to be a valid way of estimating intestinal blood loss.

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