

obstruction. Both these conditions may occur as a result of excessive vomiting. In the present series no significant association could be demonstrated between excessive vomiting and a raised serum amylase. For example, out of 11 cases having severe protracted vomiting, seven normal values and the remaining four, with raised levels, were also hypotensive. Dehydration, enhanced by vomiting and consequent vagal stimulation, could give rise to inspissation of the pancreatic secretion and occlusion of the smaller pancreatic ducts. This, in the presence of an actively secreting pancreas (after a meal), could lead to rupture of acini and enzyme absorption into the blood stream. Twelve cases in this series were grossly dehydrated, but only four had a raised serum amylase, and of these two were in addition hypotensive.

Adrenalectomy and hypophysectomy in dogs are both followed by a transient rise in serum amylase (Cope *et al.*, 1938), suggesting that these glands are intimately connected to the exocrine pancreas. Does the exocrine pancreas respond to stress or could adrenal cortical depression in some cases account for a rise in the serum amylase? There was no constant relation in this series between cases clinically described as "shocked" and the serum amylase level. Six cases of hormone-dependent breast carcinomatosis subjected to hypophysectomy or combined with adrenalectomy had serum amylase estimations determined pre- and post-operatively. None of these cases showed any significant post-operative rise, the highest recorded figure being 230 units/100 ml.

From these analyses of the case histories it is probable that many factors may be operative, either singly or together, in causing a rise in the serum amylase in an individual case. These variables must obviously be taken into consideration in the evaluation of any raised serum amylase.

#### Summary

A simple method of serum amylase estimation is critically reviewed and precautions essential in its use are described.

Serum amylase values in 41 cases of acute pancreatitis, 320 cases of conditions clinically confused with acute pancreatitis, and 89 miscellaneous conditions clearly substantiate the value of the serum amylase estimation in the differential diagnosis of acute abdominal pain.

Theories of the mode of production of a raised amylase in conditions other than acute pancreatitis are reviewed and, where possible, correlated with the clinical findings.

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## "PHISOHEX" AND SAFER SURGERY

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Widespread concern about cross-infection in surgical wards has led to a more precise reevaluation of many aseptic techniques, but some long-established and comforting rituals tend to escape this scrutiny.

The need for an improved surgical scrub technique became apparent during an investigation into sepsis rates in two surgical units of this hospital group. Using a standard classification of sepsis (Howe, 1957), it was shown that of 600 clean operations performed over a period of several months 10% developed major sepsis. Each unit had 33 beds for male and 33 for female patients, and the total of 132 beds was increased if surgical emergencies demanded. A wide variety of surgery was performed, including many emergency cases, but only those where it was believed that primary healing should occur were included in the study.

As part of the study an investigation of contact cross-infection in operating theatres was made. The incidence of glove puncture was found to be 30% in over 1,000 gloves, and experiments confirmed that organisms rapidly passed from the operator's skin to the glove exterior provided the glove was punctured and wet (Webster, 1958). Contamination therefore seemed to be possible in virtually every operation where the minimum team was three and where six gloves were either on or near the operating site. There was great variation in the time taken for a surgical scrub, the maximum being eight minutes using brush, soap, and running water. Surgeons apparently chose cleaning agents haphazardly or by individual preference from three different cake soaps, all available in the basins. These were common yellow or green soap and a hexachlorophane soap.

As the most troublesome of hospital pathogens, *Staphylococcus aureus*, is resistant to ordinary cake soap (Bayliss, 1936), it seemed possible that the adoption of a standard surgical scrub technique capable of achieving and maintaining the superficial bacterial cleanliness of the hands throughout the operation would minimize one possible source of the contamination of clean wounds. Several chemical products said to be capable of a sustained superficial sterilizing effect upon the skin are now available; of these the most desirable would appear to be a true soap substitute which simultaneously solves the problem of soap alkali allergy. An experiment was accordingly made with a soapless detergent cream incorporating 3% hexachlorophane, with a pH of 5.5, the same as skin. The soapless detergent, "phisoderm" is a water-miscible anionic detergent cream. It contains a sulphonated ether, wool fat, cholesterols, and petrolatum, and is a surface tension reductant 40% more powerful than soap. The remarkable effectiveness of

hexachlorophane as a skin disinfectant has already been described (Seastone, 1947). The detergent-disinfectant combination has been favourably compared with other detergents and antibacterial agents (Hufnagel *et al.*, 1948), and is marketed under the trade name of “phisohex.” It was made available to us through the courtesy of Bayer Products Limited.

**The Experiment**

The surgical teams involved came from the two units where the infection rate had been assessed.

Methods of assessing the contamination of the hands of an operating team at the conclusion of an operation are naturally difficult, and ultimately the “streak plate” technique was adopted. The operator removed one glove, shook any excess glove powder off his fingers, and then pressed the pads of four finger-tips on a plain agar plate. He then drew his finger-tips firmly over the surface of the agar, thus making four parallel streaks (Fig. 1). This was repeated with the second hand. The plates were then incubated for 24 hours and the numbers of colonies were counted and recorded. Growths were rarely so profuse that no count could be made, but when it occurred the result was recorded as “confluent.” As expected, the amount of contamination of the hands of the operating team at the conclusion of an operation was very heavy (see Table, Phase 1).

All soap was then withdrawn from the theatres involved in the test, and phiso-hex dispensers—either foot-operated or small squeeze-bottles—were substituted. The subjects then scrubbed for a period of three minutes, first using a brush with phiso-hex and water to clean the finger-nails and then phiso-hex and water alone to clean the hands and forearms. A further series of “streak

plates” was collected, and again the colony counts were assessed (see Table, Phase 2). The agar plates for this part of the experiment incorporated 1% “tween 80,” which inactivates phiso-hex.

Finally, after phiso-hex had been used for four weeks it was withdrawn and soap was reintroduced to the operating theatres. Streak-plate counts were again done, but this third test period began one month after the withdrawal of phiso-hex. This interval was arranged so

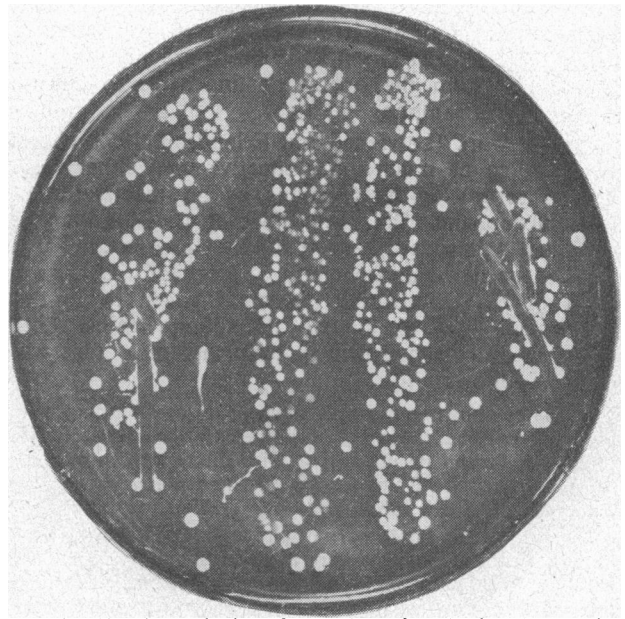


FIG. 1.—Showing colonies of organisms found with the streak-plate method.

*Post-operative “Plate Streak” Counts from Two Operating Teams*

	Theatre 1								Theatre 2							
	Surgeon		Registrar		House-surgeon		Nurse		Surgeon		Registrar		House-surgeon		Nurse	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
<i>Phase 1</i>	108	115	51	47	10	27	1,000	1,000	176	9	Absent	56	7	276	0	14
<i>Soap scrub</i>	11	500	C	26	C	1,000	250	400	200	5	26	2	250	0	0	5
		180	8	7	145	156	C	41	C	190	60	38	100	2	63	
		C	3	61	C	23	C	511	120	511	59	106	93	10		
		12	550	139	60	134	144	38		13	0		100	150		
		220		73	0	31	89	800		64			C	2		
		120		79	69	64	18	500								
		200		20	C		250									
		C		127	C		138									
		400		157	C		7									
		100		56	8											
<i>Phase 2</i>	Absent	7	0	Absent	0	0	0	18	0	71	2	1	1	0	0	0
<i>Phiso-hex scrub</i>		6	8		2	0	0	0	500T	0	0	1	1	49	0	0
		1	0		0	0	0	0	6	0	1	1	0	0	0	0
		7	54T	Absent	0	0	0	0	0	0	0	0	0	0	0	0
		3	0		3	0	0	0	5	0	0	0	0	0	16	0
		7	0		0	0	0	0	7	5	1	1	0	0	0	0
		9			0	1	0	0	0	0	0	0	0	0	0	0
		1			0	0	0	0	0	0	0	0	0	0	0	0
		5			0	0	0	0	0	0	0	0	0	10	0	0
		48			0	5	0	0	0	0	0	0	0	2	0	0
		2			0	0	0	0	0	0	8	0	0	0	0	0
		0			0	0	0	0	0	0	0	1	2	0	0	0
<i>Phase 3</i>	6	C	Absent	Absent	5	141	14	40	116	25	Absent	420	2	9	5	10
<i>Return to soap scrub</i>	1	533			10	526	14	29	950	12		123	5	92	4	30
	49	235	Absent	Absent	232	190	154	84	230	127		41	55	190	57	63
	45	216			4	324	107		145	442		22	0	129	18	30
	5	600			90	363	40		600	18		95	9	162	70	90
	119				75	194	321		195	118		140	40	85	110	120
	8					318	295			145			85	97		
							C			130						
							83			48						
							157			89						
							50									
							162									
							174									

A and B denote separate individuals in each surgical team. C=“Confluent”—that is, growths so profuse that count could not be made. T=Counts obtained when gloves were torn.

as to allow the re-establishment of skin flora. Sampling on this occasion was carried out with equal numbers of plain agar plates and plates incorporating 1% tween 80 (see Table, Phase 3).

Glove-puncture rates were not noted, but the Table contains the letter T opposite counts obtained at a time when gloves were noticeably torn.

#### Bacteriology : Control of Experiment

Before the reduced counts after phisohehex scrubs could be taken as significant it was considered imperative to assess the ability of tween 80 to inactivate any phisohehex transferred from the operator's finger-tips to culture media during sampling.

Earlier work (Lawrence and Erlandson, 1953) shows tween 80 to be much more effective than either fresh human serum or its fractions as an inactivator of hexachlorophane. Phisohehex, however, uses the soapless detergent "phisoderin," itself mildly bacteriostatic, as a vehicle for hexachlorophane. Consequently an assessment of the inactivating power of tween 80 in this experiment had to include its action against both phisohehex and its two principal constituents. This was done as follows:

1. Plates showing negative cultures after streaking with phisohehex-scrubbed fingers were immediately re-streaked with unwashed fingers or inoculated with diluted broth cultures of staphylococci. Reincubation of these plates showed no evidence of growth inhibition.

2. During the latter part of the trial of phisohehex, fresh human serum agar plates were used for sampling in parallel with tween 80 agar plates. A comparison of these plates showed that growths, if any, were always greater on tween 80 agar.

3. Four rabbits were used to provide comparable areas of shaved and artificially contaminated skin. Bacteriological sampling of these sites following a phisohehex scrub and rinsing with distilled water revealed growth of the test staphylococcus on tween 80 agar but not on plain nutrient agar.

4. Ten 1% tween 80 agar plates and 10 nutrient agar plates were flooded with 10 dilutions of phisohehex, varying from 1:5 to 1:1,000, and an exactly similar set of plates was flooded with dilutions of phisohehex varying from 1:5 to 1:90. After drying, all plates, plus two control plates, one of tween 80 agar and another of nutrient agar, were inoculated with a known number of pyogenic staphylococci. After incubation, nutrient agar plates showed complete inhibition of all growth by phisohehex, up to and including a dilution of 1:200 and by phisohehex only to a dilution of 1:5. All tween 80 agars showed uninhibited growth in every dilution of phisohehex or phisohehex.

#### Bacteriology of Trial

Streak plates were incubated at 37° C. for 24 hours. Colony counts were then recorded and the plates stored on the laboratory bench for a further 48 hours. They were then examined for the presence of *Staph. pyogenes*, which was confirmed only after the demonstration of coagulase production by the slide method, or, if this was inconclusive, by the clotting of plasma in a test-tube.

#### Results

As seen in the Table, the bacterial colony counts fell rapidly and significantly when phisohehex was used. They disappeared altogether in the case of one individual, while the majority of the other participants had approximately twice as many sterile culture plates as they did contaminated plates. Only one individual

showed successive small counts while using phisohehex, and this was the person with the highest total counts while using soap. When phisohehex was used the highest counts generally appeared either at the beginning of a week after a week-end's rest from surgery, or if gloves were torn and fingers blood-stained during dirty operations.

Growths consisted almost entirely of saprophytic skin cocci, but *Staph. aureus* was also present in very small numbers in five of the samples following soap scrubs. In these samples this pathogen appeared as an occasional colony in otherwise heavy growths.

Fig. 2 summarizes the comparable results in the Table by showing the average colony counts obtained from individual members of the surgical team who were

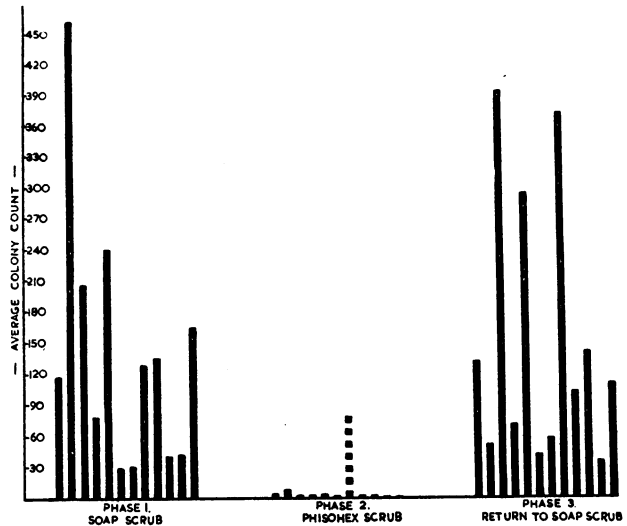


FIG. 2.—Comparison of the average colony counts of the 12 participants present throughout the experiment.

present for all three phases of the experiment. A standard value for confluent growth was not included, but this increases the significance of the comparison. The broken line in the centre of the histogram, although representing a percentage count, is largely due to a single count of 500 following a large glove tear during a dirty abdominal operation. In this culture coliforms predominated.

#### Discussion

With the increasing menace of high cross-infection rates, drug-resistant bacteria, and poor hospital hygiene, reappraisal of surgical scrub techniques as practised in this country seems overdue. In U.S.A. similar methods to those described in this small experiment have been in use for several years. While it is accepted that this is only one facet of a complex problem, we feel that surgical technique must be as suspect as other potential causes of hospital infection.

The results of this experiment indicate that the surgeon's confidence in his present scrub technique is unjustified. At the end of a surgical procedure, when contact with the wound is at its most intimate, the hands of the team are heavily contaminated, and, in the presence of glove puncture, which is to some extent unavoidable, passage of hand organisms through the puncture to the wound is likely. If these organisms include high-grade pathogens, as can be expected from time to time, serious infection may follow.

The preliminary results, which we have recorded, seem to us to justify the use of a soapless detergent

agent which includes an antiseptic—in this case hexachlorophane—but such a substance, as well as being effectively antibacterial, must also be non-irritant. With phisohehex the problem of allergy to soap alkali does not arise. In this trial it was found soothing to the skin, caused no reactions, and was preferred by the majority of participants. On the other hand, we have evidence of hexachlorophane soap allergy in one surgeon in this hospital, and, furthermore, hexachlorophane soap is less satisfactory because of the difficulty of transferring water-insoluble hexachlorophane from soap to skin. This may be one reason why the sporadic use of hexachlorophane soaps during periods 1 and 3 of this experiment showed little or no tendency to diminish the counts. The inclusion of the water-repellent lanolin in phisohehex promotes the transfer of hexachlorophane to the skin.

The scrub time of only three minutes with phisohehex brought some criticisms from the surgical staff, but the bacteriological results show it to be far more effective than soap in the circumstances of this trial. The amount of suds produced was a little less than with soap, and this again caused some criticism.

It is claimed by the manufacturers that the effect of phisohehex is a cumulative one. It did seem that the bacterial counts at the beginning of a week were somewhat higher than at the end, but the counts generally were so low that the differences here were not significant. Although a powerful disinfectant, hexachlorophane does not degerm skin quickly, as does 70% alcohol (Price, 1951). Consequently the bactericidal effect of phisohehex can be attributed to the efficient deposition of hexachlorophane as a semi-permanent film on the skin of frequent users.

Its use might therefore be justified in the pre-operative preparation of patients undergoing elective surgery, such as, for example, certain types of orthopaedic procedure. In this instance the patient would wash frequently with the agent for two or three days before operation.

Powerful inactivation of phisohehex by tween 80 agar was demonstrated during tests on the control of the bacteriological investigation. Therefore it is highly improbable that the extremely low or negative counts obtained during the trial of phisohehex were due to the transfer of small amounts of this substance to the culture plates during sampling. This supports the theory that phisohehex, used frequently, is cumulatively bactericidal to skin flora. Furthermore, if the deeper layers of saprophytic skin flora are dependent on environmental bacterial replenishment, then the constant presence of the phisohehex film on the skin of habitual users may eventually diminish those reservoirs of bacteria which are beyond the reach of the scrubbing-brush.

The experiment was too short to gauge the effect on wound sepsis in the surgical units involved, but sepsis rates certainly did not rise during the period.

### Summary

An effective and convenient technique of surgical scrubbing is described.

The assessment of the efficiency of the scrub agent—phisohehex—was determined by the fall in the number of bacterial colonies as estimated by a "streak plate" technique.

The result, which was controlled by the use of culture media inhibitory to phisohehex, showed that the new

method produced a highly significant fall in the number of colonies of skin organisms grown from the finger-pads of the surgical team at the end of operations.

The advantages and disadvantages of phisohehex and hexachlorophane soap in the surgical scrub are discussed.

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## CORRECTION OF UNIOCCULAR APHAKIA BY MEANS OF ALL-ACRYLIC ANTERIOR- CHAMBER IMPLANTS

### REVIEW OF 100 CASES

BY

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In 1951 Harold Ridley described his method for overcoming the visual defect in cases of aphakia by means of an acrylic lens inserted behind the iris and in front of an intact posterior lens capsule. He was thus the pioneer of intraocular implant surgery. By 1953, however, it was evident that this technique had its limitations. The artificial lens had to be inserted at the same time as an extracapsular extraction was performed, so that there was no means of checking the aphakic correction before the implant was inserted, and the patients in whom the posterior capsule had been divided or had been removed were not eligible. Perceiving the possibilities of this technique, and in an attempt to avoid some of its disadvantages, certain workers, such as Strampelli (1954), in Italy, Barraquer Moner (1954), in Spain, and Schreck (1955), in Germany, evolved an implant placed in front of the iris and behind the cornea, with feet wedged in the anterior chamber angles and carrying a central optical portion, the correction of which could be modified to suit the requirements of the individual case (Fig. 1). This type of implant can, and indeed should, be inserted after the eye has made a satisfactory recovery from cataract surgery, thus reducing the surgical trauma inflicted upon the eye at each session.

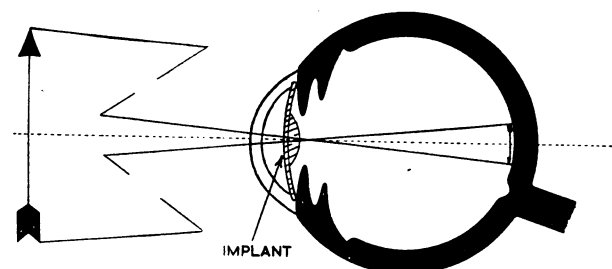


FIG. 1.—Aphakia corrected by anterior-chamber acrylic implant.